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# Weapons & Equipment of Counter-Terrorism

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MICHAEL DEWAR



# **WEAPONS AND EQUIPMENT OF COUNTER-TERRORISM**

**Michael Dewar**

In the war of the terrorist, the frontline is everywhere – in city streets, department stores, airline seats. The modern terrorist is totally ruthless. To deny him his grisly victories, security forces the world over – army, paramilitary, police and civilian – are increasingly reliant on advanced technology. This book provides a guide to the amazingly diverse weapons and equipment now available.

Throughout the world, a bizarre spectrum of terrorist organizations maintain campaigns of hatred and violence in pursuit of political aims. Few countries are now free from attack by one group of fanatics or another. Funded by clandestine sources, these guerrillas infiltrate their target societies to strike seemingly at random, making detection of raiders, their bombs and weapons exceedingly difficult.

The response by the free world has been to look to the only practical counter-measures they can use, short of means available only to totalitarian states. Explosives can be detected; bombs can be defused; and technology can be brought to bear in surveillance operations. In more open confrontations, protection can be afforded the upholders of law and order by the provision of body armour, shields and crowd-dispersal weapons.

Today, the terrorist faces an increasingly effective armoury of equipment. Security forces are becoming better trained, experienced and equipped. More and more automobile companies are producing IS vehicles; police forces are being equipped with sophisticated equipment; bomb disposal teams now have a wide range of tools to detect, disrupt and disarm every sort of explosive device. Perimeter protection is becoming big business; and in the area of communications, surveillance, monitoring, jamming and interception equipment is constantly being refined.

*Continued on back flap*







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**Front of jacket:** The face of today's security forces. On training in close quarter combat, this soldier is dressed in SAS-style black overalls over Armourshield body armour that includes a ceramic insert for enhanced protection from small-arms fire. He wears an S6 respirator against the smoke from weapons and tear gas and carries a Heckler & Koch MP5 submachine-gun. The black overalls provide good camouflage in badly-lit situations; the overall image is also aimed to strike dread into the hearts of the terrorists being confronted. (Photograph by courtesy of Armourshield Ltd)

**Back of jacket:** Top left and centre, one of the safer methods of bomb disposal, the Ro-Veh remotely controlled EOD vehicle in action. Top right, perimeter security maintained by a close-circuit television surveillance camera at the Palace of Westminster in London. Bottom left, the increasingly sophisticated image of riot policemen – anti-riot shields and protective garments from Security Equipment Supplies Ltd. Bottom right, clandestine surveillance at night; a Pilkington Eagle night observation device.



The latest models of anti-riot equipment: protective helmets with visors, shinpads, fire-resistant overalls, riot batons, riot shields, gas mask and anti-riot gun for projecting baton rounds, rubber bullets or gas grenades. (Security Equipment Supplies Ltd)

Internal security troops  
practise their role in breaking  
a hostage situation. One  
member of the team has  
already entered the house,  
the others prepare to follow  
as CS gas begins to fill the  
building. (Armourshield Ltd)



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MICHAEL DEWAR

aa  
ap

ARMS AND ARMOUR PRESS

# Glossary

AA	Anti-Aircraft	DF	Direction Finding	MOD	Ministry of Defence (UK)
AP	Armour piercing	DOV	Discreet Operational Vehicle	MPCM	Multi-Purpose Central Mount
ADP	Automatic Data Processing	ECM	Electronic Counter Measures	MTBF	Mean Time Between Failures
AFV	Armoured Fighting Vehicle	EOD	Explosive Ordnance Disposal	NOD	Night Observation Device
APC	Armoured Personnel Carrier	EOR	Explosive Ordnance Reconnaissance	OP	Observation Post
AM	Amplitude Modulation	FM	Frequency Modulation	PLO	Popular Front for the Liberation of Palestine
ATO	Ammunition Technical Officer	GPMG	General Purpose Machine-Gun	RAG	Ring Airfoil Grenade
CAM	Computerized Alert Monitor	GRP	Glass Reinforced Plastic	RCIED	Radio Controlled Improvised Explosive Device
CCTV	Closed Circuit Television	GSG 9	Grenzschutzgruppe 9 (West German CTW unit)	RDF	Radio Direction Finding
CLASSIC	Covert Local Area Sensor System for Intrusion Classification	HF	High Frequency	RF	Radio Frequency
CN	Riot control gas; tear gas precursor to CS	HOT	Haut subsonique Optiquement téléguidé tiré d'un Tube	RX	Radio Receiver
COR	Carrier Operated Relay	IED	Improvised Explosive Device	SA	Small-Arms
CRS	Compagnie Républicaine de Sécurité	II	Image Intensification	SMG	Submachine-Gun
CS	Riot control gas causing tears, salivation and painful breathing	IR	Infra-Red	SWAT	Special Warfare Action Team
CTW	Counter-Terrorist Warfare	IRA	Irish Republican Army	TI	Thermal Imaging
CWIED	Command Wire Improvised Explosive Device	IS	Internal Security	TOW	Tube-launched Optically-tracked Wire-guided
		LASS	Local Area Sensor System	TX	Radio Transmitter
		LSI	Large Scale Integration	UHF	Ultra-High Frequency
		MG	Machine-Gun	VCP	Vehicle Check Point
				VHF	Very High Frequency

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# Introduction

Since the end of the Second World War, governments throughout the world have generally had to face a greater degree of internal dissent, usually from a minority interest, than ever before. This has often taken the form of open insurrection by a sizeable minority such as in Vietnam, Malaya, Palestine, Kenya, Aden, Cyprus, and Algeria, usually against a colonial administration. More recently, however, much smaller organizations such as the Red Army Faction, the Bader-Meinhof group, the Black September movement or indeed the 300 or 400 remaining IRA activists have waged a campaign of international terrorism for political ends, seemingly unconcerned with the consequences of the mayhem they cause.

The growing threat prompted British Prime Minister Edward Heath to remark in 1971: 'We have seen in the last few years the growth of a cult of political violence, preached and practised not so much between states as within them. It is a sombre thought, but it may be that in the 1970s, civil war rather than war between nations will be the main danger that we face.' How right he was: the Vietnam war spread into Cambodia and Laos; the Northern Ireland situation worsened; the stability of Dhofar was threatened by Communist infiltration; Zimbabwe drifted into a state of civil war; troubles in Argentina and Chile rumbled on throughout the 70s, while the Soviet Union continues to fight a colonialist war in Afghanistan, the fighting in Central America threatens to grow, the Lebanon sinks deeper into chaos almost daily and the Philippines government struggles to keep the lid on revolt. The list is almost endless. Meanwhile various terrorist groupings in Europe and elsewhere hijack aeroplanes, plant car bombs and murder policemen and VIPs.

In fact, terrorism has become a feature of life in democratic Western societies. The terrorism of the 1960s and 1970s had specific objectives. In Latin America it aimed to create festering sores within the authoritarian states, which would grow until the infections took over the body politic. Symbolic

violence was the method by which this was to be achieved: sometimes this violence was aimed against individuals, sometimes against property or so-called 'economic' targets; sometimes it was against symbols themselves. In South America, where many regimes were fundamentally unstable anyway, this sort of terrorism had little effect. Elsewhere symbolic violence has been more successful. The Palestinian campaign, organized principally by the Popular Front for the Liberation of Palestine, or PLO, and more recently breakaway factions of the PLO such as the Abu Nidal group, has involved aircraft hijacking and mass murder. It served to raise the issue of a Palestinian homeland from the trough into which it had sunk after the catastrophic defeat of the Arabs in the 1967 Arab-Israeli war. Few acts of symbolic violence have equalled the taking hostage of the Israeli Olympic team at the Munich Olympics in September 1972 by the Black September movement. After the international outrage had died down, the issue of Palestinian nationalism remained at centre stage to a degree that would have been impossible had it not been for the use of terror. A series of terrorist atrocities at airports, or against aircraft, by the PLO or associated Arab terrorist groups has continued ever since. The bombing of a TWA airliner in March 1986 as it approached Athens, the bomb attack against a Berlin discotheque frequented by US servicemen and the attempted bombing of an El Al aircraft about to depart from London for Tel Aviv, both in April 1986, are but the latest (at the time of writing) acts of terrorism to draw attention to the Palestinian cause.

Similarly, other nationalist causes have used terrorism to broaden their publicity base – the IRA, the Basque ETA, and to a much lesser degree the Corsican and Breton nationalists. Terrorism has become competitive. A dead policeman in Madrid is nowhere near so compelling as a hijacked aircraft or a mass shooting at an international airport. Thus violence breeds violence, and one terrorist act feeds another. Although there are few examples in modern times of the use of terror by itself achieving

the objectives for which it was used, it can be said at least to have accelerated the political process.

Whatever its success rate, all the signs indicate that desperate and frustrated causes will be driven increasingly towards the use of terrorism to achieve their ends. It is also certain that their methods and techniques will get more sophisticated and more difficult to counter. Certain types of plastic explosives are, for example, extremely hard to detect with the conventional weapon/metal detector and may even escape detection by X-ray equipment, particularly if secreted on the person. Sophisticated 'sniffing' equipment can detect such substances, but these are both expensive for airport authorities to purchase and time-consuming to use. Such are some of the dilemmas facing security authorities today.

Western society has, in fact, made great advances in the control of conventional terrorism. Many of the terrorists of the 1970s are now dead or in prison, though the social cost of improved security has been high. Computers, especially in West Germany, have advanced the whole process of tracking down terrorists and possibly even predicting future actions. More efficient surveillance and intelligence machines in the UK have frustrated many recent IRA actions and uncovered even more spectacular illegal explosives and weapons hauls. Similarly, more effective airport security has reduced the likelihood of an effective hijacking campaign. These methods can counteract those known or potential terrorists who display a recognizable pattern of behaviour and who belong to a recognized group. What it cannot do entirely is to control the pure 'symbolic' act without a previous pattern of violence. It is generally accepted by most security organizations that the lone assassin or a suicide squad can breach the most effective systems. The latest methods and equipment are unlikely to stop the revolutionary who poisons Israeli oranges, as an Arab recently claimed to have done, or an individual who implants poison in a well-known brand of headache cure as happened in the United States in early 1986. It is impossible to guard *all* the areas or risk in a modern Western society.

In the immediate future, Western Europe is likely to continue to be a target for terrorists. West Germany, which has destroyed the threat from conventional terrorism of the Bader-Meinhof pattern by counter-intelligence and resolute action, is open to the random symbolic terrorist act against society at large rather than specific military or political targets. The IRA problem in the UK, the Basque problem in Spain and the Corsican and other problems in France seem intractable. The various Palestinian groupings, aided and abetted by Libya and possibly Syria, seem set to continue their campaigns. Islamic fundamentalists threaten to export revolution throughout the Middle East. The Lebanon continues to disintegrate. And the United States, which is already suffering terror by crime rather than by political groups, is a possible target for future terrorists.

Whether in a rural or an urban environment, operations short of conventional limited warfare are generally known as 'Low Intensity' or 'Internal Security' (IS) operations. In a rural environment it has usually been possible to use soldiers and to adapt conventional military equipment to meet any threat to the security of the state. In an urban environment, however, most governments have found it to be both militarily advantageous and politically expedient to train specialist IS forces and to develop or purchase special purpose IS equipment. It is therefore largely in the urban sense that the term 'Internal Security' is used in this book. In their widest sense, IS operations include all operations undertaken by government forces against indigenous or infiltrated armed groups that constitute a threat to the stability of the state.

In some countries, the army is automatically called upon to deal with a terrorist threat. Elsewhere, the police or specialist elements of the police are used; in the United States, various SWAT teams are trained and equipped to deal with terrorist situations; and élite police squads such as D11 of

London's Metropolitan Police have special expertise with firearms. In many countries, a so-called 'third force', designed to deal with riots and other IS situations, has been created. These are para-military organizations, as exemplified by the CRS (Compagnie Républicaine de Sécurité) in France, the Bundesgrenzschutz or Federal Border Guard in Germany, and the Guardia Civile in Spain. There are also various 'elite' units. Britain's Special Air Service, a regiment of the Regular Army, enjoys an awesome reputation worldwide; West Germany has formed GSG 9, a para-military unit armed with small-arms, machine-guns, helicopters and APCs, although they have, in fact, the status of policemen; and in the United States there are a number of such organizations, including Delta Force. Every modern police force and army does, to a greater or lesser degree, retain some sort of specialist anti-terrorist capability.

In the Western countries, commercial organizations have become increasingly involved in the business of countering terrorism. Most offer a complete range of anti-terrorist equipment, some or all of which they manufacture themselves. Although there are such organizations elsewhere in the world, the majority of the most successful are in the UK and USA. In the UK organizations such as Control Risks specialize in the solution of kidnap situations. Others, such as the SAS Group of Companies, established as long ago as 1952, have concentrated on providing anti-terrorist equipment. Although SAS do provide training packages to go with much of their equipment, they are primarily in the business of selling equipment. Historically they have concentrated on bomb disposal equipment; but they also supply detection, inspection and disruption equipment for terrorist Improvised Explosive Devices (IED) as well as conventional Explosive Ordnance Disposal (EOD) and riot control and surveillance equipment.

This book does not attempt to analyze, list or describe the many terrorist groupings that have terrorised the Western world since the 1960s, nor those extant today. That is the subject of a separate book, and many authors have tackled it recently. The conclusions of these volumes have often been depressing, pessimistic and offering little hope for the future. The aim of *this* book is more positive: it is to demonstrate the extent of the civil and military anti-terrorist infrastructure, its techniques and the panoply of sophisticated equipment that is available to combat terrorism successfully from whatever

source the threat may come. It is hoped that the book will encourage the faint-hearted.

The reader will doubtless perceive a quantitative bias in favour of the United Kingdom. This is no accident. Partly it reflects the nationality and experience of the author; to a much greater degree it reflects the actual situation, brought about for the most part by the British experience in Northern Ireland since 1969. The British are world leaders in IS equipment research and development, in its manufacture and in anti-terrorist techniques and equipment. The United States, which has historically suffered terror by crime rather than by political groups, is also a leading manufacturer of IS equipment. But the many other countries featured in this book illustrate the fact that most industrialised countries now manufacture some of their own IS equipment. France, the Federal Republic of Germany,

**Below:** Long-range surveillance. A Modulux image intensifier attached to a telephoto lens on an SLR camera. Such a system is used, for example, in Northern Ireland to photograph IRA gunmen at funerals so that identification and arrest can follow.





Italy, Switzerland, Belgium, Spain and the Netherlands are now significant producers in the IS equipment field.

Coverage in this book cannot possibly be comprehensive. That would require a work stretching to many volumes, which would be highly repetitive and probably very boring. Such is the speed of development of IS equipment and the rate of expansion of the IS industry that this book can only hope to illustrate a representative range of different categories of equipment from all over the world. Nor does the book aim to illustrate just the latest equipment. Rather it presents a representative cross-section of both the latest technology and well tried equipment that has been in service for some time. No other book to date has brought together such a range of IS equipment.

The West, as this book demonstrates, is well armed and well prepared to deal with the continued onslaught of terrorism. Security forces are becoming better trained, equipped and more experienced. Civilian companies now provide not only equipment but guards, expertise and complete training pack-

ages. More and more automobile companies are producing overt and covert IS vehicles, and police forces are being equipped with sophisticated anti-riot and anti-terrorist equipment. Bomb disposal teams now have a wide range of advanced equipment to detect, disrupt and disarm every sort of explosive device. Scientists are working on still more sensitive explosives detection equipment for airports. Perimeter protection is becoming big business as security forces, public utilities and industry invest in safeguarding their assets. Perhaps the most interesting area of all is that of communications, where highly sophisticated surveillance, monitoring, jamming and interception equipment is constantly being refined. The terrorist faces an increasingly effective and sophisticated armoury of equipment. The effort must and should continue. If, as seems likely, propaganda by the deed becomes the principle means of revolutionary violence, it is the developed world that will suffer the brunt of the attack. The assault will be, not so much on institutions or individuals, but on affluence and the Western way of life.



# Internal Security Vehicles

Today most armoured personnel carriers tend to be tracked in order to perform their primary cross-country role in general war as efficiently as possible. However, tracked vehicles are not best suited to the IS role for a number of reasons. They are often difficult and expensive to operate and maintain; they are more noisy than wheeled vehicles; they can cause damage to road surfaces; and, most important of all, they are classed as 'tanks' by the layman and the media. Use of 'tanks' in an IS situation is often politically unacceptable. In most IS situations, vehicles are required to operate mainly on roads and in an urban environment, so that wheels are more suitable in every respect.

Most IS armoured vehicles are 4 × 4-wheeled vehicles affording protection from small-arms fire up to and including 7.62mm. Some of the heavier IS vehicles afford protection against 7.62mm armour-piercing attack. IS vehicles must be provided with observation blocks so that the crew can see what is happening around them. In a conventional rural environment, when a vehicle is likely to be operating in wide open spaces in conjunction with many other vehicles and infantry on the ground, it is not so vital that a vehicle crew has a comprehensive all-round view of the ground. However, in an urban environment, in order to prevent a petrol bomber, for instance, approaching an armoured vehicle via a blind spot, an ideal IS vehicle must have good all-round vision. Similarly, firing ports should be provided so that the crew can, if required, use their small-arms from within the vehicle.

Vulnerable points on the vehicle such as the fuel tank and the radiator should be given special protection, particularly from petrol bomb attack. The other main threat is from attack by anti-tank grenade. Certainly in Northern Ireland, the IRA have used RPG-7 rocket launchers against APCs with limited success – APCs are insufficiently armoured to prevent penetration by projectiles from rocket launchers. However, in a urban environment the close range at which terrorists are forced to engage APCs mitigates against a successful engage-

ment. The limited exposure time of an armoured vehicle passing a fixed point means that the firer has very little time to recognize the target, prepare to fire, acquire the target, aim and engage. Often RPG-7 projectiles have passed behind their target, on some occasions unnoticed by the occupants of the vehicle.

An IS vehicle must be so designed as to allow rapid access and egress by crew and passengers. There are many examples of IS vehicles where this characteristic has been included in the design. Clearly, in a confused situation probably involving large and disorderly crowds, it is only sensible to have multiple doors in an IS vehicle. In a conventional war situation, the enemy is normally expected from a single direction. In a guerrilla situation, the enemy may attack from any quarter. The requirement is therefore to be able to leave the vehicle from the opposite side to the direction of attack. Side doors also dictate that there should be only four wheels, an arrangement that is also sensible in the interests of simplicity and mechanical reliability.

IS armoured vehicles can be fitted with a variety of armament installations, including water cannon, tear gas launchers, and machine-guns. Some can even be electrified to prevent rioters climbing on to the vehicle. In addition to armoured vehicles, there are a number of other types of vehicle that are commonly used in IS situations: water cannon vehicles, which may or may not be armoured; conventional 'soft skin' vehicles that have been covered in a form of appliqué lightweight armour as protection against blast and low-velocity rounds; and armoured bulldozers for the removal of barricades. Appliqué armour was first developed for the British Army in an attempt to provide some protection for Land Rover crews against blast, fire and acid bombs and low-velocity small-arms fire. GRP is a form of fibreglass used to cover the body and roof of Land Rovers, while Macralon, a form of strengthened plastic, is used to cover windscreen and windows.

Older vehicles can be adapted in many ways for IS purposes. In Northern Ireland, for example, the



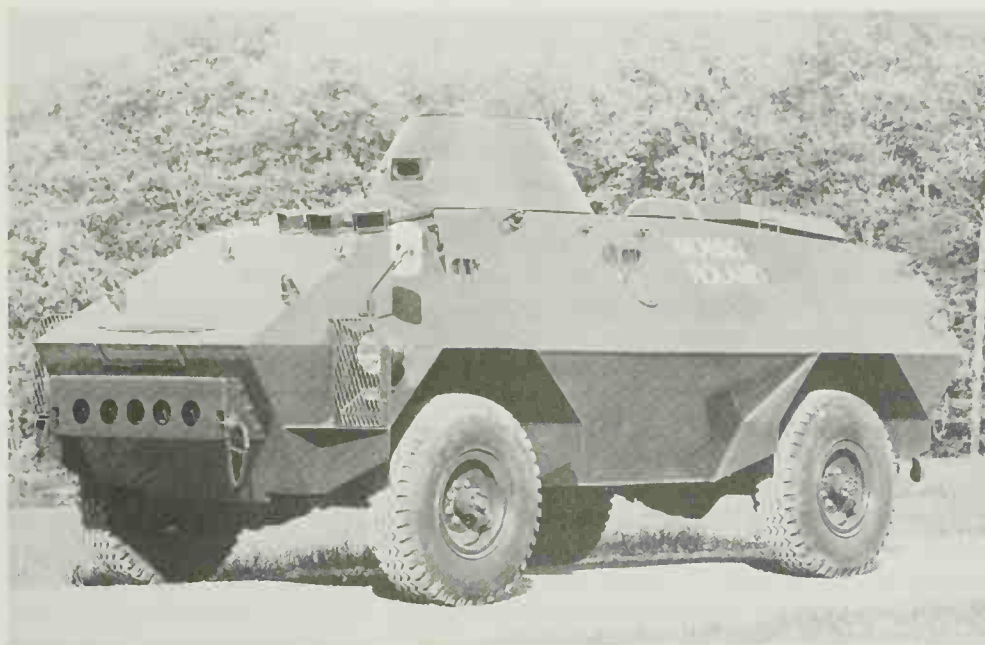
British Army has adapted the long-serving GKN Sankey AT-104 IS vehicle, commonly known as the 'Pig', by attaching unfolding fenders to each side of the vehicle. Thus the vehicle, if parked in the middle of a relatively narrow road flanked by buildings, can block most of the road off and afford protection against missiles thrown by rioters. The adapted vehicle is known as the 'Flying Pig'. Other possible attachments are roof- or turret-mounted searchlights, loudspeaker systems and a strong device for removing barricades. A self-help device that is fitted to many jeeps and Land Rovers in the IS role is a fence picquet attached vertically to the front of the vehicle to cut steel wires stretched across roads, the intention of which is to cause serious injury to the occupants of open vehicles.

A common threat to the IS vehicle, particularly in a rural environment, is the land mine. The design of IS vehicle hulls should ideally be such that, if a mine is triggered off by one of the vehicle's wheels, the upward slope of the hull should deflect much of the

blast and the strong monocoque structure should provide maximum protection so long as the crew are strapped into their seats. Examples of a shaped hull are the South African Hippo vehicle, the British GKN Sankey Saxon and Italy's Fiat 6614CM APC.

IS vehicles should be of simple and rugged construction. They are often in use in less developed countries with limited maintenance resources. A vehicle that has followed such a design philosophy closely is the GKN Sankey Saxon. It is powered by the widely available Bedford 500 6-cylinder diesel truck engine, and the use of commercially available automotive parts means that anyone who can maintain a truck can also maintain the Saxon. Similarly, the French Berliet VXB anti-riot vehicle uses 'off-the-shelf' Berliet truck spare parts and is both easy and cheap to maintain. Design details are very important. For example, in the Belgian Beherman Demoen BDX, the engine air intake is located below the generous canopy over the driving position and has a moving shutter to provide further protec-

**Right:** The Roland IS vehicle, one of a range built by Mowag of Switzerland, which is in service with a number of countries. As with many vehicles built for internal security operations, it comes in various forms; the customer can specify details such as the armament, turret arrangement and other specific features. The hull shape shows the special care devoted by designers today to attaining maximum protection for the occupants against not only small arms fire but also mines and road obstacles.



tion against Molotov cocktails. The twin exhaust pipes run along the two sides of the roof to make it more difficult to climb on to the vehicle.

A growing number of police forces throughout the world recognize that discreet operational vehicles (DOVs) – standard commercial vehicles and limousines that are armoured without appearing to be so – are less provocative for low and medium risk IS environments than the more heavily armoured, obviously military hybrid vehicles. There will continue to be IS situations that warrant the attendance of highly protected military vehicles, but in many incidents the use of DOVs could be more politic and just as effective. Confrontation with lightly armed terrorists, student demonstrations and the carriage and escorting of government VIPs are examples. The current range of DOVs include:

- Land Rover and Range Rover type vehicles for anti-terrorist operations, with a cross-country capability and all-round protection against handguns, submachine-guns, grenade fragments and certain categories of rifles;
- VIP limousines with all-round protection against handguns, submachine-guns and grenade fragments;
- Saloon cars and Range Rover type vehicles for VIP escort duties, with partial protection against handguns, submachine-guns and grenade fragments;
- Fast patrol cars for immediate response and pursuit, with frontal protection only against hand-guns and submachine-guns.

Modern technology is narrowing the gap between what is technically feasible and operationally desirable in terms of both opaque and transparent armour. However, thought does need to be given to the design of a DOV: the answer is not necessarily to cram as much armour on to a given chassis as possible. Users often tend to ask for unrealistic and often unnecessarily high levels of armour, while insisting on minimum changes in vehicle performance and appearance. In reality the two are often irreconcilable. Manufacturers, whose experience is usually confined to automotive engineering, on the other hand, tend to offer a solution that does not take into account sufficiently the operating conditions and protection requirements of the user. If, for instance, a manufacturer decides that the main threat to a head of state is from the 7.62mm NATO rifle or its equivalent, the passenger section of his armoured limousine can be given complete protection against single shots from this weapon. But, in order to avoid significant modifications to the engine and the suspension, the driver's section would need

to be left unprotected. An IS expert would advise that a driver killed or incapacitated at speed would be likely to end with the death of the head of state anyway! Moreover, where the protected limousine is for a head of state, the need for protection to this degree can be questioned: sensible precautions along a route should reduce the opportunities to use a high-powered rifle and, where such use is very likely, the VIP should change his route or cancel the engagement altogether. A much more likely threat is from the assassin in the crowd armed with a concealed handgun or submachine-gun. All-round protection against this threat, rather than an attempt to armour only the rear section of a limousine against the unlikely use of a 7.62mm weapon, would be the wiser bet.

Successful DOV design should start from the premise that no DOV will be bulletproof. The best protection will merely buy time. The armoured Lincoln Continental limousine delivered to the US Secret Service in 1969 carried two tons of armour steel and bullet-resistant glass, and was capable of travelling at 50mph with all the tyres shot out. The Secret Service would have been the first to admit that its most attractive characteristic was its ability to maintain mobility with all its tyres deflated – the mass of armour could not have protected the occupants from sustained fire from high-power automatic rifles available on the open market. It might have resisted the first few rounds, so giving time for the agents travelling in the back-up vehicles to return fire, or for the chauffeur in the protected limousine to put his foot on the accelerator.

Some of the problems that arise in attempting to bring about a compromise of discretion, protection and performance will be apparent from the weapons and armour table. This gives the ballistic properties of a selection of weapons used by terrorists and the necessary thickness and weight of various armoured materials currently in use. Lighter materials with similar or superior resistance qualities are under development, but they are not yet widely in use. It can be seen from the table that even all-round protection against a low-velocity 9mm SMG will impose a considerable weight penalty. Such protection would seem to be a sensible minimum for VIP limousines, with the possible addition of selected points being protected against 7.62mm high-velocity rifle attack in high-risk areas of the world. It is possible to compensate for the increased weight by restricting the number of persons in the vehicle or by modifying the chassis, suspension and engine.

If the occupants of a DOV are in a position to return terrorist fire, then there are different options.

### Terrorist weapons and armour materials used to resist them

Weapon	Muzzle Velocity	Impact Energy at 50m	Aluminium		Steel		Composite		Glass		Glass/ Polycarbonate mm
	m/sec	mkg	mm	kg/m <sup>2</sup>	mm	kg/m <sup>2</sup>	mm	kg/m <sup>2</sup>	mm	kg/m <sup>2</sup>	
Pistols											
9mm Luger	338	47	4	11	2	14.58	6.86	13.7	25	61	—
.38 Colt	260	35	6	16.6	2	14.58	6.86	13.7	25	61	—
.38 S & W	185	16	4.5	12.5	2	14.58	6.86	13.7	25	61	—
.357 Magnum	439	101	7	19.5	2	14.58	8.66	17.1	25	61	—
Submachine-guns											
9mm Sterling	390	64	7.5	21	2	14.58	8.66	17.1	29	70	—
.45 Thomson	280	58	7.5	21	2	14.58	8.66	17.1	29	70	—
Rifles											
7.62 Ball Nato	855	380	27.5	70	5	39.38	15.23	42.3	63	150.7	35.5'
5.56mm Armalite 990		173	21	59					63	150.7	35.5'

Notes: A curved windscreen of glass/polycarbonate mix now available is capable of stopping single shots from the NATO 7.62mm rifle and the 5.56mm Armalite (both ball). The armour data is drawn from international sources. Resistance figures are derived from tests held under varying conditions. BSS 5051 Part 1 (1973) details appropriate performance requirements and test methods for security glazing. It makes provision for spall from the rear surface when attack takes place. These stringent conditions are not universally applied.

**Right:** International co-operation in IS vehicle development, the Transair Multi-Role Armoured Vehicle (see page 29). This machine is capable of withstanding missiles and bullets – and of pushing blazing vehicles from its path.



A fast patrol car may only need a bullet-resistant windscreen, an armoured engine bulkhead and armour added to the inside of the front doors and the rear of the front seats. Providing only two persons use the car, it would normally require no modification to engine or chassis in order to achieve the same performance as the original version of the car with four persons in it. An escort vehicle, however, would normally require more extensive protection, if only because it might have to serve as a temporary refuge for a threatened VIP.

Wheels are particularly vulnerable points on a DOV. Some sort of 'run-flat' capability is essential for accidental or induced blow-outs at speeds and to enable the driver to extricate the vehicle from an ambush if the tyres are shot out. There are various solutions. One involves the fitting of steel discs inside the tyres so that the weight of the vehicle is supported when the tyres are deflated. Another is

the Dunlop Denovo system, which injects a lubricant between the deflating tyre and the wheel rim. Both systems allow the vehicle to be driven out of an ambush – the Denovo system permits it to be driven for up to a hundred miles.

There is no doubt that DOVs have their place in the fight against terrorism. Assassination or kidnapping of VIPs is now a favourite terrorist tactic. Ostentatious personal protection precautions can be counter-productive in PR terms, particularly for a politician, and are likely to be exploited for propaganda purposes by political dissidents. DOVs, on the other hand, can provide an effective low-profile alternative.

This chapter does not aim to cover all international IS vehicles – a very large book would be required to achieve this. Rather, it aims to cover a representative cross-section of IS vehicles from the international field.





**Above:** The Engesa Urutu EE-9. This is the anti-riot version, fitted with barricade bulldozer blade, search lights, flashing lights, wire mesh protection over engine louvres, etc. against hand-thrown missiles, grenade dischargers, individual firing ports, siren and other special features.

## BRAZIL

### Engesa EE-II Urutu APC

Designed and built by Engesa of São Paulo, Brazil, this is an armoured amphibious vehicle designed to perform various roles, and which can be transformed into a family of vehicles. The engine of the Urutu is at the front on the right of the driver, which leaves the rear of the hull free for a compartment capable of accommodating up to 14 men or carrying 1,800kg of cargo. A large door in the rear of the hull and a door on each side provide alternative means of entry or exit. There are four hatches in the rear compartment in addition to the

driver's hatch. The vehicle is fitted with firing ports. The engine air louvres can be closed to eliminate the risk of flames from Molotov cocktails entering the engine compartment, and cooling air is then admitted into the engine from the crew compartment through a pneumatically operated hatch which is normally closed.

**Variants:** The design allows it to be transformed into a family of vehicles: in addition to the APC version, the Urutu can be used as an armoured ambulance, a command and communication vehicle, and an armoured cargo vehicle. Engesa EE-9 Cascavel is an armoured car variant. The overall specification is similar, the main differences being its turret-

mounted 90mm gun and the fact that it is not amphibious, although it has a fording capability of one metre.

**Employment:** The riot-control version is in service with the Brazilian Army and Marines, Bolivia, Chile, Colombia, Gabon, Iraq, Libya, Tunisia, United Arab Emirates.

**Data:** length 6m; width 2.59m; height 2.09m (to hull roof); ground clearance 0.34m; wheel-track 2.1m; wheelbase 3.05m; weight 11,000kg (unladen), 14,000kg (laden); engine Detroit diesel 6v-53 developing 212hp at 2200rpm; crew 14; number of wheels 6 × 6; speed 95kph; range 750km; gradient 60%; vertical obstacle 0.6m; fording depth amphibious; turning radius 10m; maximum side slope 30%; armament – cupola for .50cal MG or 20mm automatic gun and turret or 60mm gun mortar and turret or 90mm cannon with coaxial 7.62mm NATO MG and turret.

## CZECHOSLOVAKIA

### Tatra OT64 APC

The OT-64 is based on the Tatra 815 truck, development of which started in 1959. The passengers, protected by 10mm of armour, are situated at the rear of the vehicle and are provided with overhead hatches, rear exit doors and firing ports.

**Variants:** Model 1 (7.62mm MG in an unprotected mount); Model 2 (12.7mm or 7.62mm MG with curved shield); Model 3 (14.5mm and 7.62mm MGs in an armoured turret); Model 4 (same armament as Model 3 but with a higher turret); Model 5 (the Model 1 with two Sagger anti-tank missiles mounted over the rear of the passenger compartment); and the two command models, the R2 and R3.

**Employment:** Czechoslovakia, Egypt, Hun-

gary, India, Libya, Morocco, Poland, Sudan, Syria, Uganda.

**Data:** length 7.47m; width 2.52m; height 2.24m; ground clearance 0.38m; weight 14,515kg (laden); engine Tatra T-928-14 V-8 diesel developing 300bhp at 2000rpm; crew 20; number of wheels 8 × 8; speed 90kph; range 650km; gradient 60%; vertical obstacle 0.5m; swims.

## EGYPT

### Walid APC

An open-top 4 × 4 vehicle produced in Egypt, and used for both military and police work.

**Employment:** Algeria, Burundi, Egypt, Israel, Sudan, Yemen (PDR).

**Data:** engine German Deutz air-cooled; crew 10; number of wheels 4 × 4; armament normally Goryunov SGM 7.62mm MG.

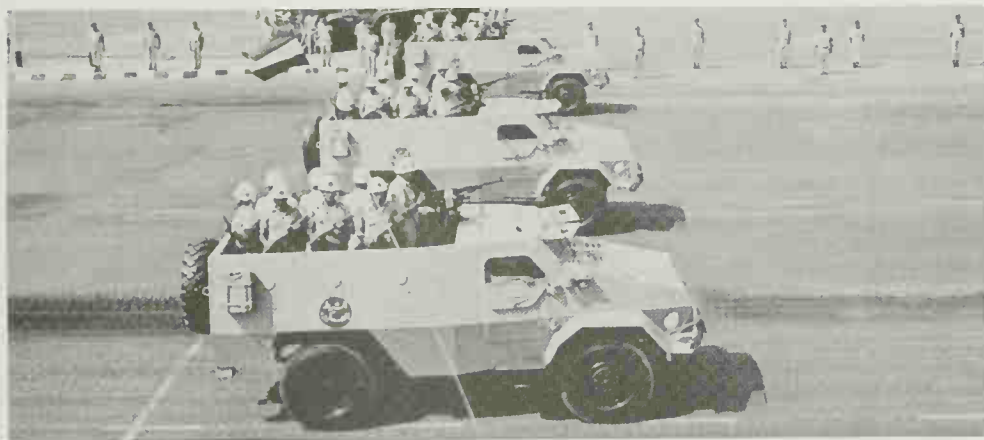
## EIRE

### Timoney BDX IS Vehicle

Design studies for this vehicle were started in January 1972 by the Irish company Technology Investments Ltd (TIL), primarily to the specifications of the Irish Department of Defence. The first prototype was completed in July 1973 and two more prototypes were built by mid-1974. These three prototypes successfully concluded an exhaustive evaluation programme. A production licence was taken out by the Belgian company Beherman Demoen of Bornem: hence the designation BDX. The vehicle is designed primarily for urban combat, but is also able to perform more conventional military duties in a rural environment.



**Right:** Egypt's Walid vehicle, which is used for both internal security and normal military purposes. The Egyptians have succeeded in exporting a number to various friendly governments in the immediate Middle East region.







**Above and above right:** Ireland's Timoney BDX vehicle. The multi-language labels on the control array in the cockpit indicate switches for sirens, smoke projectors, air filters, searchlights, etc.

**Right:** The French Berliet VXB 'Gendarmerie' vehicle, here fitted with bulldozer blade.

Its 12.5mm armour is thicker than on most other vehicles of its kind and provides protection against 7.62mm armour-piercing bullets fired at short range, yet does not involve excessive weight. The driver is seated well forward to give him the widest possible field of view and has a large windscreen of laminated glass possessing the same strength as the vehicle body, with two smaller side windows of the same material. The provision of these relatively large windows meets the need for good vision from within an armoured vehicle in urban operations. Doors in each side, as well as in the rear of the hull, meet the third requirement for urban operations, namely the provision of multiple means of entry or exit. Production is now complete.

**Variants:** The BDX can be fitted with a dozer blade for clearing barricades; and there are various turret options.

**Employment:** Argentina, Belgium (Air Force and Gendarmerie), Eire (Army).

**Data:** length 4.95m; width 2.41m; height 2.13m; ground clearance 0.38m; wheeltrack 1.9m; wheelbase 2.85m; weight c. 8,250kg (unladen), c. 9,350kg (laden); engine Chrysler 360 CID V-8 spark ignition, developing 200bhp at 4000rpm; crew 12; number of wheels 4 × 4; speed 100kph; range 640–960km; gradient 60%; vertical obstacle 0.4m;

swims; turning radius 14m; maximum side slope 45%; armament 7.62mm L37, L7 or L8 GPMG; or .50 Browning MG; or 7.62mm MG MAG; or twin 7.62mm MG; or 81mm mortar.

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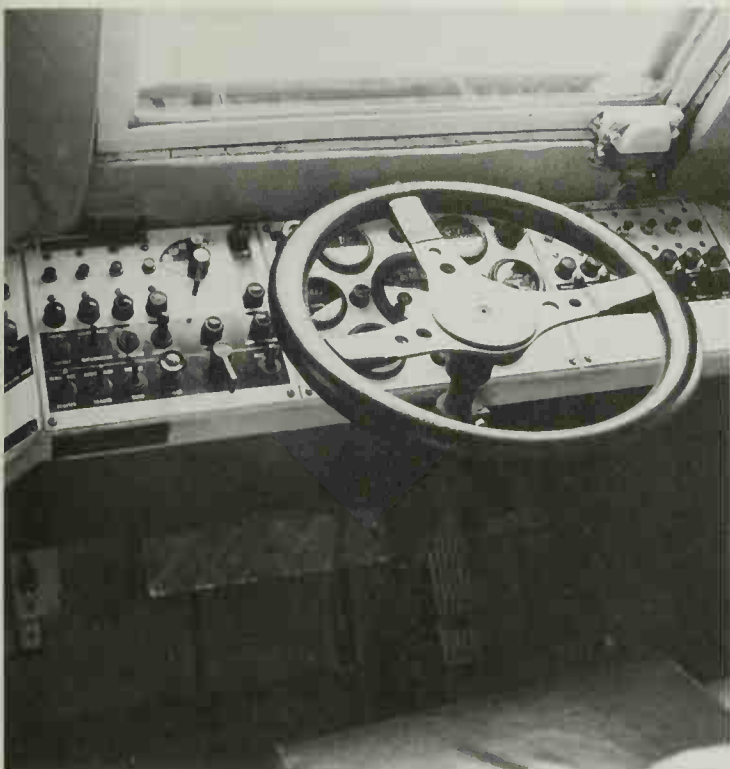
## FRANCE

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### Berliet VXB 'Gendarmerie' IS Vehicle

Designed to meet the particular requirements of police armoured units, this vehicle has been in production at Berliet's Bourg factory since 1973. The characteristics that make the VXB ideal for IS missions include the large crew compartment of 11 cubic metres, the excellent visibility with no blind spots (the windows are bullet-proof glass reinforced with steel mesh), easy entry and exit (two large doors in the sides and one at the rear), effective protection against small-arms fire, mines and bombs (engine air intakes can be blocked) and good manoeuvrability. One VXB prototype was fitted with the TOP7 commander's cupola of the AMX 30 battle tank, one of the best observation cupolas available; its experimental installation illustrates the importance given to vision in the VXB anti-riot vehicle.

**Variants:** The VXB 'Combat' is designed to meet the requirements of modern armoured



units and can mount a wide range of armaments. The VXB 'Gendarmerie' can be equipped with a dozer blade and/or a hydraulic winch. Production is now complete.

**Employment:** France (Gendarmerie), Gabon, Senegal, Tunisia.

**Data:** length 5.9m; width 2.44m; height 2.05m; ground clearance 0.38m; wheeltrack 2.04m; wheelbase 3m; weight 8,900kg (unladen), 12,000kg (laden); engine Berliet diesel, developing 170bhp; crew 15; number of wheels 4 × 4; speed 85kph; range 750km; gradient 60%; swims; turning radius 15.6m; armament externally mounted 7.5mm or 7.52mm MG.

### **Ford (France) IS Reconnaissance Vehicle**

Basically a Ford Transit, this vehicle has been converted to carry nine riot policemen. It is equipped with radio, a public address system and anti-riot grills. It is used to transport a quick-reaction force in urban areas.

**Employment:** France (CRS); Transit vans are also used by IS forces the world over.

### **Panhard IS Vehicles**

**AML H60-7 Armoured Car:** Development of the AML series started in 1956. The wide





range of possible armaments, the good performance and low operating cost (the Panhard 4HD engine does 100km on about 26 litres) have made the AMI particularly appreciated by those countries with a restricted military budget. The H600-7 version has been specially designed for IS and anti-guerrilla operations, and for use in built-up areas.

**Variants:** AMH 90 Reconnaissance Vehicle mounting a 90mm gun; AMI 60/20 Reconnaissance Vehicle mounting a 60mm mortar and a 20mm cannon.

**Employment:** 4,000 AMIs of all types have been produced, including 700 for the French Army and Gendarmerie. The AMI is also used by Abu Dhabi, Algeria, Burundi, Cambodia, Chad, Congo, Ecuador, Eire, Ethiopia, Iraq, Israel, Ivory Coast, Kenya, Lebanon, Libya, Mauretania, Malaysia, Morocco, Nigeria, Portugal, Rwanda, Saudi Arabia, Senegal, South Africa, Spain, Tunisia, Upper Volta, Venezuela, Zaire and Zimbabwe.

**Data:** length 3.79m; width 1.97m; height 1.86m (to turret roof); ground clearance 0.31m; wheeltrack 2.05m; wheelbase 2.7m; weight 4,800kg; engine Panhard 4HD 4-cylinder 1,997cc 90hp; crew 3; number of wheels 4 x 4; speed 90kph; range 600km; gradient 60%; fording depth 1.1m; turning radius 13.1m; maximum side slope 30%; armament one 60mm CMAI Hotchkiss Brandt gun/mortar breech- or muzzle-loaded, and two AA-52 NF-1, or 7.62mm MAG-80 MG.

**M3 VTT APC:** The M3 series was designed as a troop transport complement to the AMI towards the end of the 1960s. In relation to the size of its hull the vehicle has an exceptional carrying capacity of eleven men plus the driver. The M3 uses many of the components of the AMI, but has the additional advantage of being amphibious without preparation. Protection for the personnel on board, who can use their individual weapons through six side ports and enter and exit through two large rear doors, is provided by 10mm armour plate and attention has also been given to protecting all apertures against the entry of inflammable liquids.

**Variants:** M3 VDA AA weapon system, armed with two HS 820 SL (or M693) 20mm cannon; M3 VTS Ambulance; M3 VPC Command Vehicle, armament as for VTT; M3 VAT Recovery Vehicle. Production is now complete.

**Employment:** Abu Dhabi, Angola, Congo, Eire, France, Iraq, Kenya, Lebanon, Malaysia, Portugal, Saudi Arabia and Spain. **Data:** length 5.31m; width 2.5m; height 1.75m;



**Top left:** The French CRS transport vehicle, simply a specially adapted Ford Transit van, like many others worldwide.

**Centre left:** The Panhard AML H60-7, some 4,000 of which are in use around the world.

**Bottom left:** Panhard's M3 vehicle. This picture illustrates the potential firepower of this kind of vehicle in that it has three firing ports for small-arms on each side plus two GPMGs. The rear FN machine-gun (with butt fitted) is in a cradle designed to cover the rear arc but can be removed for use on foot.

**Right:** The Panhard Buffolo, based upon the M3 but updated. Note the searchlight, turret vision slots for anti-riot surveillance, the winch and the wire mesh protection on the engine louvres, etc.

**Below right:** The Panhard VBL high-speed IS intervention vehicle, latest of the Panhard range of vehicles, which is used by the French police and CRS.



ground clearance 0.47m; wheeltrack 2.12m; wheelbase 2.95m; weight 5,800kg (laden); engine Panhard 4HD 4-cylinder 1,997cc 90hp; crew 12; number of wheels 4 × 4; speed 90kph; range 600km; gradient 60%; swims; turning radius 13.1m; maximum side slope 30% forward armament one swivel-mounted weapon support for 7.5mm or 7.62mm AA-52 MG; or TL2 152 turret mounting two 7.62mm MG; or T20 turret mounting one 20mm cannon and coaxial 7.62mm MG; rear armament one weapon support revolving on semicircular rail for 7.5mm or 7.62mm AA-52 MG or a MAG-80 MG.

**Buffolo:** The Panhard Buffolo MO (Maintien

de l'Ordre) is a 4 × 4 armoured vehicle weighing 6.6 tons, carrying six men and specifically designed for IS situations. It is equipped with an Hispano-Suiza Puma turret and is powered by a Peugeot 71 KW XD3T diesel engine. The hull, which is based on the Panhard M3 APC, has been redesigned to smooth out the sharp edges on the earlier models.

**Employment:** Six units have been ordered by the police of an unspecified country.

**VBL:** The Panhard VBL law enforcement version has just been launched. Panhard estimate that the potential market for this type of light armoured vehicle in its various







**Top left:** The Saviem/Creusot-Loire VMO 4 × 4 vehicle, fitted with a bulldozer blade. The turret carries a searchlight, smoke dischargers and a machine-gun.

**Above:** The German Rheinstahl UR416. This illustration demonstrates IS vehicle manufacturers' tendency to utilize standard truck chassis and parts on which to base specialist vehicles, in this case a standard UNIMOG chassis.

**Left:** The Mercedes-Benz Water Cannon vehicle. Although adopted by the British Army in Northern Ireland in the early 1970s, water cannon are seen in the UK as being too high-profile for use in riot-quelling. In Northern Ireland, such a cumbersome and vulnerable vehicle would be difficult to extricate from a street riot.

configurations is 5–10,000 units. Of this total, the French Army is expected to order as many as 3,000. It is believed Mexico, Ireland and Nigeria have bought several dozen units, while Saudi Arabia, another Middle Eastern country, several Far East nations and the US Army are all showing interest.

### Renault S170 Riot Vehicle

The S170 Riot Vehicle is equipped with a water cannon for crowd dispersion. The 6,000-litre water tank and its water-foam cannon allows the vehicle to double as a fire-fighting vehicle and to protect security forces on the ground against petrol bombs.

### Saviem S95 Command Vehicle

Developed by Saviem, the S95 command vehicle is a good example of the type of police/paramilitary vehicle that is ideal for controlling complex urban situations involving the deployment of IS forces throughout a large urban area. The vehicle is equipped with radio telephone and radio communications facilities that permit control of a large number of sub-stations. Though still in use, this vehicle is now obsolete.

**Employment:** France (CRS).

### Saviem/Creusot-Loire VMO IS Vehicle

Saviem in collaboration with Creusot-Loire (the two Companies formed the Société des Matériels Spéciaux Saviem-Creusot-Loire) produced the VAB, from which the VMO is derived, to meet a specification issued in 1969 by the French General Staff for a multi-role amphibious wheeled armoured vehicle to fill a forward tactical support role. The vehicle was adopted in mid-1974 by the French Army, which purchased 4,000 over a ten-year period. The VMO is an IS variant of the VAB and first appeared in 1977. Illumination on the VMO is provided by a searchlight that pivots with the gun mounting. Optional equipment comprises a periscope (magnification × 1) linked to a retractable sight (magnification × 3), pivoting with the weapon mounting, plus four side observation periscopes. The weight of the turret, including weapons, ammunition and optics, is 270kg. An optional item of equipment is a hydraulically controlled dozer blade, which enables the vehicle to breach road barricades, etc.

**Variants:** The VAB is also produced in a 6 × 6 version and with a variety of armaments, including HOT or TOW missiles, twin 20mm AA MG and 20mm or 30mm cannon. Command and recovery variants are available.

**Employment:** Central African Republic, Cyprus, France (Army), Ivory Coast,

Lebanon, Mauritius, Morocco, Oman, Qatar, United Arab Emirates.

**Data:** length 5.98m; width 2.5m; height 2.06m; ground clearance 0.4m; wheeltrack 2.07m; wheelbase 3m; weight 10,900kg (unladen), 12,900–13,900kg (laden); engine 235hp diesel; crew 12; number of wheels 4 × 4; speed 90kph; range 1,300km; gradient 50%; swims; maximum side slope 35%; armament in TLIG light turret manufactured by Creusot-Loire situated centrally and mounting a 7.62mm MG and a 40mm grenade launcher.

## GERMAN FEDERAL REPUBLIC

### Mercedes-Benz Water Cannon

This is a conventional Mercedes-Benz truck chassis with completed coachwork by Saval-Kröenberg of Hedel. The vehicle is fitted with two powerful water cannon, and a large quantity of water is carried in the rear. Though still in service, this vehicle is now obsolete.

**Employment:** West Berlin Police, several state police forces in West Germany, and the British Army.

### Rheinstahl UR416 APC (IS Version)

Development work on the UR416 started in 1965 and it went into production in 1969 with Thyssen Maschinenbau of Witten-Annen (formerly Rheinstahl and now Thyssen-Henschel). The UR416 is a light armoured vehicle produced expressly for IS and frontier patrol work. Although the designers used an existing chassis on which to base their vehicle, the 1.5-tonne Daimler-Benz UNIMOG S-404 light truck, it differs from most other vehicles of its type in having an armoured shell (6mm steel plate resistant to 7.62mm AP projectiles), which can be very easily removed for mechanical repairs and servicing. The crews are transported sitting back-to-back, facing the observation/firing ports and close to the three large exits. Visibility is good in front, where large windcreens are provided for the commander and driver. The vehicle also mounts a dozer blade and 'cow-catcher' for clearing barricades and other obstacles that are likely to be encountered in an urban IS situation.

**Variants:** Turret with either single or twin 7.6mm MG and three smoke dischargers mounted on each side; or turret mounting 20mm Rh 202 cannon; or turret mounting 90mm MECAR assault gun; or turret mounting COBRA or TOW guided weapons.



**Above:** The IFV version of the Israeli Ram V-11, which is particularly suitable for rural IS situations. Here it is equipped with three 7.62mm machine-guns.

**Employment:** The UR416 has had substantial export success. 300 have gone to Peru, 20 to Venezuela, 30 to Togo, 20/30 to Kenya, 2 to The Netherlands, 20 to El Salvador, 15 to Greece, 30 to Morocco, and 10 to the German Police. Interestingly, 17 UNIMOG chassis with armoured shells produced in Sweden have been in service in the Irish Army since 1972. The UR416 is also in service in Ethiopia, Spain, Turkey and Zimbabwe.

**Data:** length 5.2m; width 2.26m; height 1.24m; ground clearance 0.44m; wheeltrack 1.62m; wheelbase 2.9m; weight 4,600kg (unladen), 6,300kg (laden); engine 110hp 6-cylinder Daimler-Benz OM-32 water-cooled diesel; crew 10; number of wheels 4 × 4; speed 80kph; range 700km; gradient 70%; vertical obstacle 0.55m; fording depth 1m; turning radius 12.9m; armament externally-mounted 7.62mm MG.

## ISRAEL

### Ram Light Armoured Vehicles

The Ram is manufactured by Ramta Structures and Systems, which is a subsidiary of Israel Aircraft Industries Ltd of Beersheba. There are five versions of the Ram: the

TCM-20 20mm Twin Cannon Mount; the Close Range Tank Hunter (Destroyer) carrying a 106mm recoilless gun; the Long Range Tank Hunter (Destroyer) mounting a TOW missile system; the Infantry Fighting Vehicle; and the RAM V-11 APC. The last two are suitable for IS operations: both are basic, but rugged vehicles.

**The Infantry Fighting Vehicle (IFV):** This configuration is equipped with three 7.62mm machine-guns, night vision equipment and a multi-channel transceiver.

**RAM V-11 APC:** This version carries a total of 8–10 men and all their personal equipment. Its unique system of folding armour-plate hatches, which can be fully or partly opened, provide all-round observation while affording protection against small-arms fire. Various armament combinations are possible, including 0.5in machine-guns, 0.3in machine-guns and 40mm grenade launcher. In addition it is fitted with night vision equipment and multi-channel transceiver/receiver. Both the IFV and APC versions have an exceptional power-to-weight ratio, ensuring good acceleration and a high top speed. Armour is 8mm thick and provides effective protection against close range small-arms fire. The underside of the vehicle is 10mm steel plate, V-shaped to give a maximum protection against mines.



**Above:** Fiat's 6614, seen here with side firing ports open. Through these apertures small-arms or riot guns can be used. The sloped underside of the vehicle is intended to aid protection from mines by diverting the blast to the sides.

**Employment:** Israel Defence Force.

**Data:** length 5.02m; width 2.03m; height 1.72m (APC 2.2m); ground clearance 0.38m; wheelbase 3.4m (long wheelbase version 5.42m); weight 5,400kg combat-loaded (APC 5,700kg); engine Deutz 6-cylinder 132bhp; crew 6+2 (longer wheelbase version 8+2); speed 96kph; range 800km (APC 750km); gradient 70% (APC 65%); vertical obstacle 0.8m; fording depth 1m; turning radius 7.2m; maximum side slope 35%.

## ITALY

### Fiat 6614CM APC

The 6614CM APC and its companion vehicle, the 6616BM Armoured Car, are the first armoured vehicles to be built in Italy since the end of the Second World War. With a good performance, and using the same mechanical components, these are relatively advanced vehicles without being too sophisticated. The aim is simplicity, reliability, safety and low cost. Firing ports are provided for individual weapons, and exit from the vehicle is reasonably simple through the large rear ramp and two side doors.

**Variants:** 6616BM Armoured Car with revol-

ving turret mounting a 20mm automatic cannon and coaxial 7.62mm MG plus a variable smoke grenade-launcher, breech loaded from inside the turret, and six fixed-range smoke grenade dischargers. Alternatively, TOW or MILAN missiles can be fired from the turret. In 1985 Fiat announced a development of the 6614CM, the 6634G.

**Employment:** Italy (Carabinieri, Army), Libya, Peru, Somalia (270 ordered 1977 and delivered by 1979), South Korea and Tunisia (120 ordered in 1979). The vehicle is still in production in Italy and South Korea.

**Data:** length 5.86m; width 2.5m; height 1.78m (to hull roof); ground clearance 0.37m; wheel-track 1.96m; wheelbase 2.9m; weight 7,000kg (unladen), 8,500kg (laden); engine Fiat 6-cylinder diesel developing 160hp at 3,200rpm; crew 11; number of wheels 4 × 4; speed 100kph; range 700km; gradient 60%; vertical obstacle 0.45m; swims; turning radius 7.96m; maximum side slope 30%; armament 12.7mm Browning M2 Heavy MG, 7.62mm MG.

### Fiat 55-13 Armoured Bus

The Fiat 55-13 armoured bus is specially designed for police use in activities such as riot control, surveillance, safe transport of personnel and the patrol of areas where the crew may be exposed to small-arms fire or to





**Above:** The Japanese Police Anti-Riot vehicle. Japanese rioters tend to equip themselves as well as their police 'opponents', so it is important that IS vehicles there are well protected. (Press Association)

**Above, centre:** The Fiat 55-13 Armoured Bus for safe and speedy deployment of police at riots and demonstrations. It is a vehicle typical of many in service in Europe for safe transit of police personnel.

Molotov cocktails or stone-throwing. The driver has the benefit of excellent visibility, which helps to avoid collision with demonstrators when driving through dense crowds. This fast and powerful vehicle allows rapid police deployment during riots. The steel armour-plating covered by the body paneling, and the windows in 27mm-thick bullet-proof glass, can stand up to pistol or sub-machine-gun fire. The fuel tank and radiators are also protected. The two side-doors and single rear-door are fitted with safety locks and a limiting device to prevent the doors being forced open from the outside. Firing ports can be provided to allow the crew to use weapons and to eject tear-gas bombs; there is an observation hatch on the roof. Options available are a fire-fighting system, which sprays on to the wheels, engine and fuel tank; fireproof coating for electric cables and fuel pipes; a tear-gas filtering system; and an air conditioning system.

**Employment:** Italy (Police).

**Data:** length 5.8m; width 2.1m; height 3m; ground clearance 3m; wheelbase 3m; weight 5.8 tons (gross); engine Fiat 8000.04 diesel, 6-cylinder developing 130hp at 3,200rpm; crew 1+10; number of wheels 4 × 2; speed 110kph; gradient over 40%; turning radius 5.5m.

## JAPAN

### Police Anti-Riot Vehicle

A specification of this vehicle is not available from Japanese sources. The vehicle was first



seen in use in Tokyo in November 1971 manned by the Tokyo Police Department and is now thought to be retired from service. The vehicle's equipment includes powerful water guns and searchlights. Side exits are provided. It is the only known example of a purpose-built, Japanese manufactured anti-riot vehicle as opposed to an adapted mass-produced police vehicle. Its formidable armour is reminiscent of an earlier period in Japanese history.

## SOUTH AFRICA

### Arm Scor AC 200 Mine Protected Armoured Support Vehicle

This vehicle is a high-mobility, mine protected armoured support vehicle carrying up to 13 men and suitable for use on IS rural operations. The vehicle has both side and rear exits and its windows and firing points allow the crew to engage targets from within the vehicle, while individual hatches on the roof allow riflemen to look out of the top of the vehicle. South African security forces have had to contend with mined roads, so the wedge shape of the hull of the vehicle is designed to deflect the force of an explosion upwards and outwards. The relatively high position of the crew compartment in relation to the ground gives added protection.

**Variants:** The vehicle is available in 4×4, 6×6 and 8×8 configurations. The 8×8 version is available as a logistics, recovery and technical support or transporter vehicle. The 6×6





**Above right:** The powerful South African AC 200 vehicle. The danger from mines on South Africa's many rough-surfaced roads is reflected in the heavily armoured underside, which is shaped to deflect blast. It can be seen from the use of glass in the driver's cab, etc., that this vehicle is specifically designed for use in urban and riot situations.

**Right:** The South African Ingwe security vehicle, another rugged machine especially designed to withstand mine attack.



version is available in configurations including troop carrier, ambulance, command vehicle and transporter.

**Employment:** South African Defence Forces.  
**Data:** *weight* 18 tonnes; *engine* V-8 turbo-charged intercooled diesel; *crew* 3+10; *number of wheels* 4 × 4 or 6 × 6; *speed* 108kph; *range* 1,000km at 80kph; *gradient* 70%; *vertical obstacle* 0.6m; *trench crossing* 1.2m; *fording depth* 1.2m; *armament* one 7.62mm MG, two 7.62mm AA MG.

### **Sandock-Austral Ingwe Security Vehicle**

The Sandock-Austral Ingwe is a high-mobility four-wheel drive IS vehicle suitable for use by civilian security companies, police or military. Its hull design offers excellent protection to

crew and passengers against land mines and its hull provides protection against small-arms fire up to 7.62mm ball ammunition. In its standard form the interior layout will accommodate fourteen persons, but different seating layouts may be specified and a range of optional extras are available, including various radio fits, searchlights, weapons mounting points and turrets and heavier armour protection. Ingwe uses proven, commercially available equipment with ease of maintenance in mind. The vehicle is a simple and highly practical IS vehicle.

**Employment:** Thought to be about to enter service with the South African Defence forces.

**Data:** *weight* 10,000kg; *engine* 6-cylinder







**Above left:** The Swiss Mowag Wotan IS vehicle on parade in Chile. This is a simple IS utility vehicle in wide use in South America and in Germany.

**Above:** The Mowag Spy, the latest in the range of Mowag IS vehicles. It can be seen that the basic design has hardly changed in thirty years. Its crew of 3 and fast speed make it particularly suited to the reconnaissance role in rural areas.

**Left:** The Mowag Piranha. The remotely controlled turret machine-gun allows the commander to produce fire without exposing himself. An impressive amphibious capability is afforded by the propellers at the rear.

diesel developing 124kw at 1,700rpm; crew 2+12; number of wheels 4 × 4; speed 100kph; range 500km; gradient 60%; vertical obstacle 0.6m; trench crossing 1.04m; fording depth 1.2m.

## SWITZERLAND

### Mowag IS Vehicles

Mowag of Kreuzlingen have produced a family of wheeled vehicles, most of which are either specifically designed for, or are suitable for, IS work. The principal vehicles are detailed below.

**Mowag Wotan:** This was first produced in 1957/8, and in 1959 twenty were supplied to the German Frontier Police, who subsequently decided to equip all their mobile units with it. In 1962 Henschel (now Thyssen-Henschel) produced 260 under licence, most of them without armament and fitted only with an observation cupola for the vehicle commander; this was designated SW-1 Kfz-91. A number were fitted with a turret mounting a 20mm Mk 20-1 (HS 820) cannon, and this version was designated SW-11 Kfz-91.

**Employment:** Wotans are still in service with the German Frontier Police, West German Police, and in Chile.

**Data:** length 5.31m; width 2.2m; height 2.22m (to top of turret); ground clearance 5m; wheel-track 1.95m; wheelbase 2.6m; weight 8,600kg; engine Chrysler R-319 6-cylinder petrol, developing 161bhp; crew 7; number of wheels 4 × 4, steering on all; speed 85kph; range 400km; gradient 60%; armament manually operated 7.62mm MG mounted externally.

**Mowag Piranha IS Vehicle:** The Piranha family of 4 × 4, 6 × 6 and 8 × 8 armoured vehicles are fairly recent Mowag developments. There are three different hull lengths, with 2, 3 and 4 axles, accommodating 8, 10 and 11 men respectively. The vehicle is available in an amphibious 4 × 4 version and this is the most suitable for IS operations. The front, side and rear armour is capable of withstanding horizontal fire from NATO 7.62mm ammunition, the floor is proof against anti-personnel mines and the roof against splinters.

**Employment:** Details are not available.

**Data** (non-amphibious 4 × 4 version): length 5.39m; width 2.5m; height 1.85m (hull); ground clearance 0.5m; wheel-track 2.18m (front); wheelbase 2.5m; weight 7,750kg (laden); engine Detroit diesel 8.2-litre V-8;

crew 8; number of wheels 4 × 4; speed 100kph; range 700km; gradient 70%; turning radius 12.6m; maximum side slope 35%; armament turret for .50 M2 MG (4 × 4D) or remote-control 7.62mm MG (4 × 4P).

**Mowag Roland IS Vehicle:** A smaller, lighter and faster 4 × 4 APC, in all other respects similar to Piranha.

**Employment:** In service with several unspecified countries, including several in South America.

**Data:** length 4.73m; width 2.05m; height 2.1m (to top of turret); ground clearance 0.42m; wheel-track 1.67m (front); wheelbase 2.65m; weight 4,900kg (laden); engine Chrysler 8-cylinder V90; crew 5-6; number of wheels 4 × 4; speed 110kph; range 570km; gradient 60%; fording depth 1m; turning radius 13.7m; maximum side slope 30%; armament – turret for .50 M2 MG or remote-control 7.62mm MG; optional equipment includes obstacle-removing equipment and searchlight on turret.

**Mowag Spy:** The Spy is the latest in the range. It has been specifically designed as a reconnaissance vehicle for all types of terrain and climate; so was the British Ferret and the French Panhard AML H60-7, but both were more widely used on IS duties than any other Western vehicle during the 1950s and 60s and into the 70s. The excellent power-to-weight ratio of 27hp/ton gives the Spy exceptionally good acceleration and mobility. Its crew of three makes it more suitable for rural IS operations, providing escorts for convoys or VIPs.

**Data:** length 4.5m; width 2.5m; height 1.67m (hull); ground clearance 0.5m; wheel-track 2.18m (front); wheelbase 2.5m; weight 7,500kg (laden); engine Detroit diesel 8.2-litre V-8; crew 3; number of wheels 4 × 4; speed 110kph; range 700km; gradient 60%; fording depth 1.3m; turning radius 12.6m; maximum side slope 35%; armament as Roland, plus option for twin .30 and .50 MGs.

**Mowag Grenadier:** Like the Wotan, this is an older member of the family, but still in service in many parts of the world. It was developed to fulfill several roles including that of an IS vehicle. A variant lacks the propeller drive.

**Data:** length 4.9m; width 2.43m; height 1.75m (to hull roof); ground clearance 4m; wheel-track 1.99m (front), 2m (rear); wheelbase 2.5m; weight 5,000kg (unladen), 6,000kg (laden); engine as Roland; crew 8; number of wheels 4 × 4; speed 100kph; range 750km; gradient 70%; swims; turning radius 12.9m; maximum side slope 30%; armament as Roland, but can also mount 25mm Oerlikon cannon.







**Left:** The Vickers Valkyr in police colours. Developed for a wide range of security and military purposes, this is available with various armament configurations including twin 7.62mm machine-guns, water cannon, and a number of gun/mortar combinations.

**Below and below left:** The Transaif Multi-Role Armoured vehicle. Note the one-way glass in the surveillance slots, with firing ports below. The multi-exit capability permits very rapid debussing and deployment of personnel for maximum surprise and shock effect.

## UNITED KINGDOM/BELGIUM

### Vickers Valkyr IS Vehicle

This is a new versatile wheeled armoured vehicle developed and produced by Vickers Defence Systems in association with Behrman Demoen. Amphibious without preparation and easily air-portable, it is designed to meet the needs of military or police forces anywhere in the world who require fast, dependable, comfortable, and well-protected transport over all kinds of terrain. It is available as a purpose-built personnel carrier or fire-support vehicle, or for a variety of other roles, such as ambulance, mobile command post, or IS vehicle. Valkyr's high-hardness steel monocoque hull provides protection against 7.62mm armour-piercing ammunition fired at point-blank range against the frontal arc (including windscreens), all-round protection against 7.62mm ball fired at point-blank range and 155mm shell splinters. If required, appliqué armour can be added to give increased protection against 7.62mm

armour-piercing ammunition. The engine and transmission are fully enclosed within the hull armour, providing the highest degree of protection for the automotive system, transmission and brakes. The General Motors 453T diesel engine combines high power-to-weight ratio with speed and fuel economy. The option of 2- or 4-wheel drive greatly increases the range available from the 200-litre fuel tank, while the locking differentials and fully independent suspension, coupled with power-assisted steering, give the vehicle an excellent cross-country performance. For the IS role, Valkyr allows a ten-man force with all its equipment to deploy quickly and safely. A wide range of specialist equipment is available, including searchlights, water cannon, grenade launchers, and bulldozer blade. The excellent visibility for the driver provided by three armoured glass screens greatly simplifies manoeuvring in confined spaces.

**Data:** length 5.6m; width 2.5m; height 2.27m; ground clearance 0.4m (laden); wheelbase 3.1m; weight 11,500kg (laden); engine General Motors 453T diesel, developing 780hp at 2,800rpm; number of wheels 4 × 2 or 4 × 4; speed 100kph; range 700km; gradient 60%; turning radius 8m; swims.

## GERMAN FEDERAL REPUBLIC/ UNITED KINGDOM

### Transaif Multi-Role Armoured Vehicle

Designed and marketed worldwide by Transac International Ltd of the United Kingdom, this vehicle is manufactured and armoured by Thiele of Bremen. It is a very recent product, and negotiations are under way with various IS organizations; sales are said to be imminent. The hull is constructed of steel armour capable of withstanding high-velocity rifles at point-blank range. The strength of the windows is 'compatible to hull protection'. The vehicle has three exits, is equipped with bullet-proof run-flat tyres and a fire extinguisher system. It is, in short, a highly sophisticated vehicle.

**Variants:** It is intended to market the Transaif in three versions.

**Law Enforcement Vehicle:** This version is intended for riot-control, civil unrest and anti-terrorist activities. It is capable of transporting 14 fully equipped men and provides protection against small-arms fire, petrol bombs and blast or fragmentation attack. The styling of the Transaif can be refined so as to provide a



**Below:** The updated Ferret armoured car, here displaying a full array of specialist internal security features including enlarged tender for barricade removal, grenade launchers, searchlight, turret-mounted machine-guns and surveillance equipment

deterrent or passive appearance, and it is capable of continuous high speed on motorways — useful for fast deployment or when carrying out VIP escort duties.

***Bomb Disposal Vehicle:*** This version provides a self-contained protected environment for bomb disposal experts and their equipment.

***Airport Security:*** This is equipped with short-wave radio systems, radar and laser scanners, CCTV systems and noise/movement detectors. It can be used as a command vehicle, for the transportation of VIPs within airport boundaries, or can deliver a reaction force to the scene of an incident.

***Data:*** length 7.3m; width 2.5m; height 3.1m; weight 10,000kg (unladen), 14,800kg (laden); engine Mercedes Type OM352A 6-cylinder diesel, 168hp; crew 14; number of wheels 4 × 4; speed 105kph; range 680km.

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## UNITED KINGDOM

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### Alvis Logistics Armoured Vehicles

**Ferret 80:** This is a lightweight, multi-purpose

scout and IS vehicle. It has been designed to satisfy the needs of armies for a cost-effective replacement for the world-renowned Ferret (see Daimler). Incorporating improved protection and equipment levels, crew accommodation and vehicle performance over its predecessor, Ferret 80 is offered in a number of variants to perform reconnaissance, liaison, border control and IS roles. The hull is fabricated from aluminium alloy armour, welded to provide ballistic integrity and sealed for fording. The hull is immune against threats from heavy machine-guns and proves particularly effective against machine-gun and overhead shell burst. The power plant is a lower-powered version of that fitted in the Scorpion and Stormer vehicles. An Allison MT653DR five-speed automatic transmission is fitted, with manual selection of first gear. Three limited-slip differentials are incorporated in the drive train, one in the transfer unit, and one in each axle. Suspension is fully independent. The steering is power-assisted; run-flat tyres are used.

**Variants:** These include a two-man reconnaissance, a three-man reconnaissance and



**Below:** The British Army's stalwart Saladin armoured car, now given a new lease of life by Alvis. The vehicle illustrated carries a vertically mounted picket iron for cutting steel hawsers or wires designed to decapitate or injure vehicle commanders, grenade launchers, wire mesh protection for the vehicle commander and surveillance equipment.

increased firepower variants, the latter mounting the Helio FVT800 or FVT900 turrets. These variants are all based upon a common hull.

**Employment:** Negotiations are reported to be continuing with several customers.

**Data:** length 4.23m; width 2.34m; height 2.35m (two-man recce), 2.44m (20mm turret), 2.52mm (three-man recce); ground clearance 0.38m; wheeltrack 1.93m; wheelbase 2.72m; weight 5,150kg (two-man recce), 6,500kg (20mm turret), 6,000kg (three-man recce); engine Perkins T6-3544 6-cylinder diesel, developing 116kw at 2,600rpm; crew 2-3; number of wheels 4 × 4; speed 96kph; range 560km; gradient 60%; vertical obstacle 0.38m; turning radius 7.3m; maximum side slope 40% (two-man recce), 35% (others); armament 7.62mm MG (two- and three-man recce), Helio FVT900 turret with 20mm cannon or Helio FVT800 with twin MGs.

**Saladin Mk 2 (FV601):** The Saladin armoured car has been well proven throughout the world for defence and policing activities. Owing to its popularity, Alvis Logistics is

making available reworked vehicles. These have undergone an extensive programme, bringing each vehicle close to its original specification. All major assemblies and supporting equipments have been completely stripped and reworked, either by Alvis or the original equipment manufacturer, using genuine spare parts. The firepower of the vehicle remains the same as the original specification, as does the ballistic protection of the hull and turret.

**Employment:** Many countries including Germany, where the Frontier Police use a version (designation 'D') with extra German equipment and without the coaxial machine-gun; its designation is SW-111 Kfz-93 Geschützer Sonderwagen III.

**Data:** length 5.28m (including gun); width 2.54m; height 2.39m; weight 10,500kg (unladen), 11,200kg (laden); engine Rolls-Royce B80 8-cylinder petrol, developing 160bhp at 3,750rpm; crew 3; number of wheels 6 × 6; speed 72kph; range 400km; gradient 42%; fording depth 1.07m; armament one 76mm gun and 42 rounds of ammunition, one 7.62mm MG coaxial with main armament,







**Above:** Another veteran vehicle, the Saracen, here fitted with anti-rocket cage designed to prematurely detonate hollow-charge RPG-7 anti-armour rockets, which have been fired on a number of occasions at security vehicles in Northern Ireland. Saracens are also still used in the role of ambulance in Northern Ireland but no longer as APCs.

one 7.62mm MG for commander, and two 6-barrelled smoke dischargers.

**Saracen (FV 603):** The first Saracen prototype was built in 1952, and the production run was ended in 1972. The Saracen has been used in the IS role in many parts of the world, and is still used by the British Army in Northern Ireland. Its armour varies between 8mm and 16mm in thickness. As with Saladin, reworked vehicles are now available.

**Variants:** FV 604 Command Post, FV 610 Command Post and Ambulance versions are available.

**Employment:** Brunei, Hong Kong (Police), Indonesia, Jordan, Kuwait, Libya, Nigeria, Qatar, South Africa, Sudan, Thailand, United Arab Emirates and United Kingdom.

**Data:** length 4.85m; width 2.51m; height 2.44m; wheeltrack 2.08m; wheelbase 1.52m; weight 8.63 tonnes (unladen), 10.16 tonnes (laden); engine Rolls-Royce B80 8-cylinder petrol, developing 160bhp at 3,750rpm; crew 12; number of wheels 6 × 6; speed 69kph;

range 380km; gradient 42%; vertical obstacle 0.46m; fording depth 1.07m; turning radius 14.63m; maximum side slope 45%; armament, one 7.62mm or .30 MG in turret, one 7.62mm MG on ring mount at rear of vehicle, two 3-barrelled smoke dischargers.

### AMAC IS Vehicles

The AMAC Corporation ('Armoured Mobile Anti-riot Control Unit') has developed a family of vehicles intended to complement each other.

**AMAC 1:** This vehicle can be operated either independently or as one of a co-ordinated group of vehicles. Its excellent surveillance, deterrent, defensive and communication facilities place it among the most advanced purpose-designed IS vehicles in the world. It is equipped with a PA system, water cannon, weapon ports, grenade launchers, an electrically 'live' exterior bodywork, and a hostile fire detection unit. The air conditioning system provides a slightly high interior atmo-



spheric pressure to prevent the entry of noxious fumes or smoke. Protection is afforded against small-arms up to NATO 7.62mm. The vehicle is equipped with a highly sophisticated surveillance system, including an infra-red video camera, internal TV monitor, infra-red driving lights and retractable search- and floodlights.

**AMAC 2:** The AMAC 2 command vehicle is designed to co-ordinate up to ten AMAC 1 riot control vehicles, in the field. Its sophisticated communication facilities mean that it can hear and see (if fitted with video transmission system) what is happening around each AMAC 1 from a great distance away. Its communication, recording and transmission capabilities are considerable, enabling it to be in continuous radio and video contact with each AMAC 1, to exercise a central control over any situation and to communicate with base.

**Variants:** AMAC 3 will be a multiple water-cannon vehicle with a 9,000-litre capacity; AMAC 4 will be a lighter, smaller, faster

version of AMAC 1. Both have yet to enter full production.

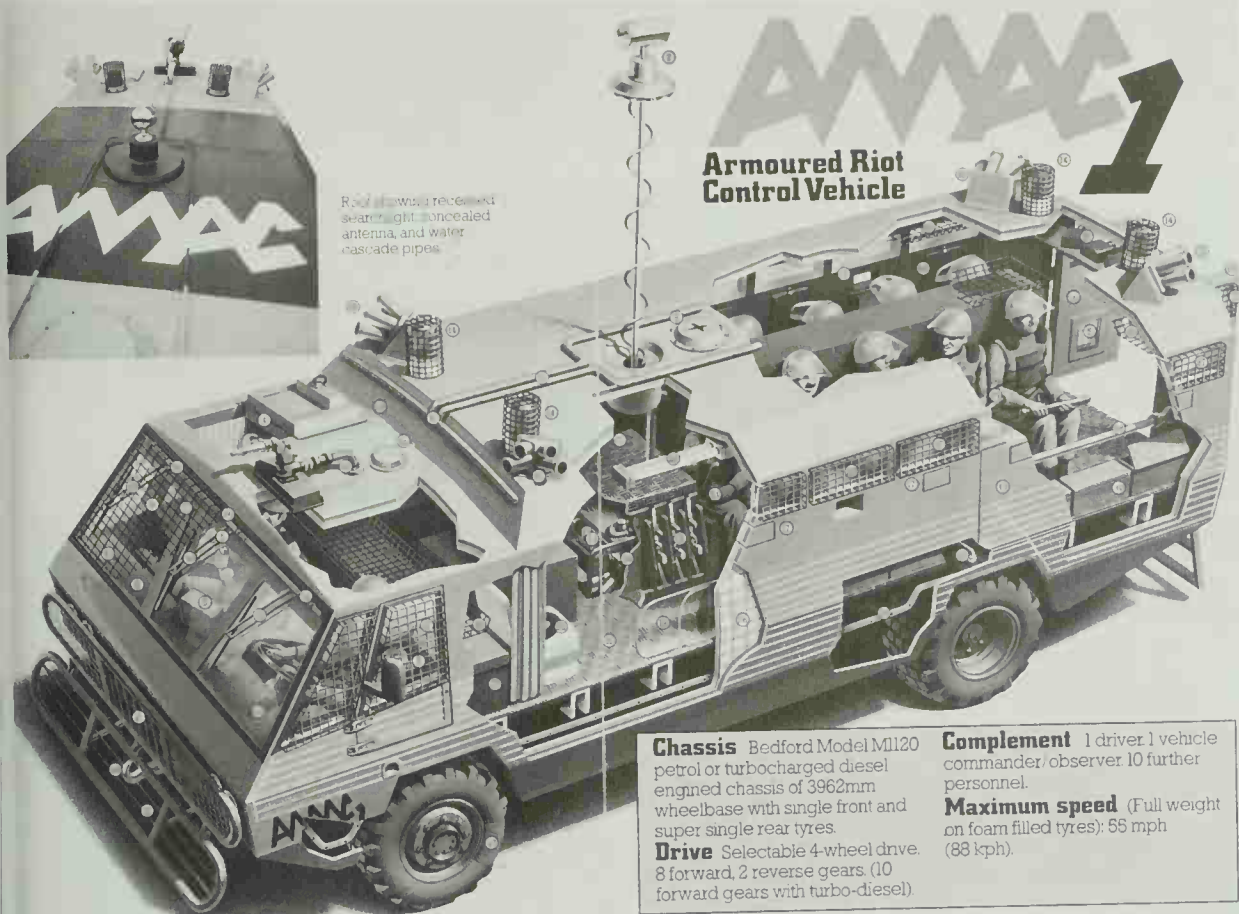
**Data:** wheelbase 3.96m; engine Bedford M1120 petrol, or turbocharged diesel; crew 12 (AMAC 1), 5-6 (AMAC 2); number of wheels 4 × 4; speed 88kph; armament 16 grenade launchers, 18 weapon ports.

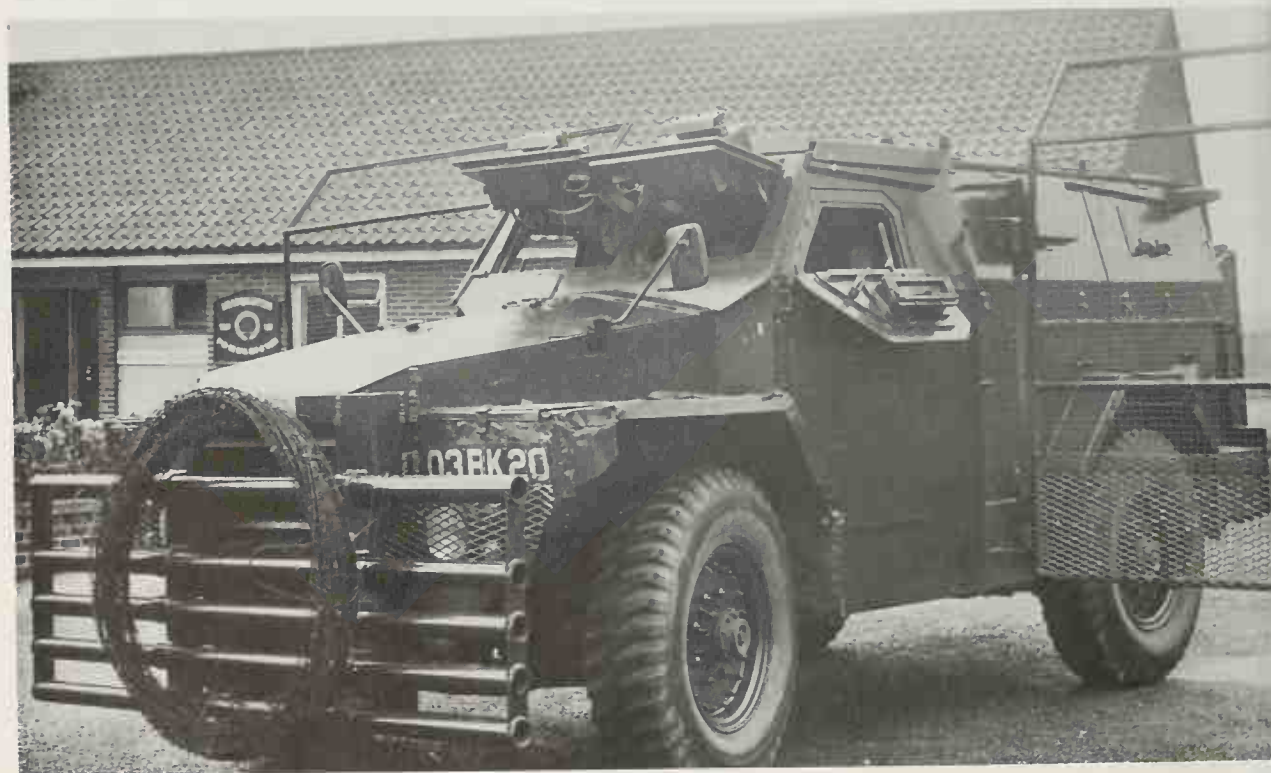
### Daimler Ferret Mk 5 Scout Car

The first Mk 1 Ferret was completed by Daimler in 1949; production of the Mk 5 continued until 1971. The Ferret was further developed into the Fox, which started production in 1973. The Ferret has been used in IS situations throughout the world, and was used by the British Army in Northern Ireland until the late 1970s. Vehicles are still available from Alvis Logistics.

**Variants:** Ferret Mk 1/1 (Scout Car Liaison open-topped version), Mk 1/2 (Scout Car Liaison with small turret), Mk 2/2 (two-door MG turret), Mk 2/3 (Scout Car Reconnaissance with 7.62mm MG in a turret), Mk 2/6 (Scout Car Reconnaissance guided weapon),

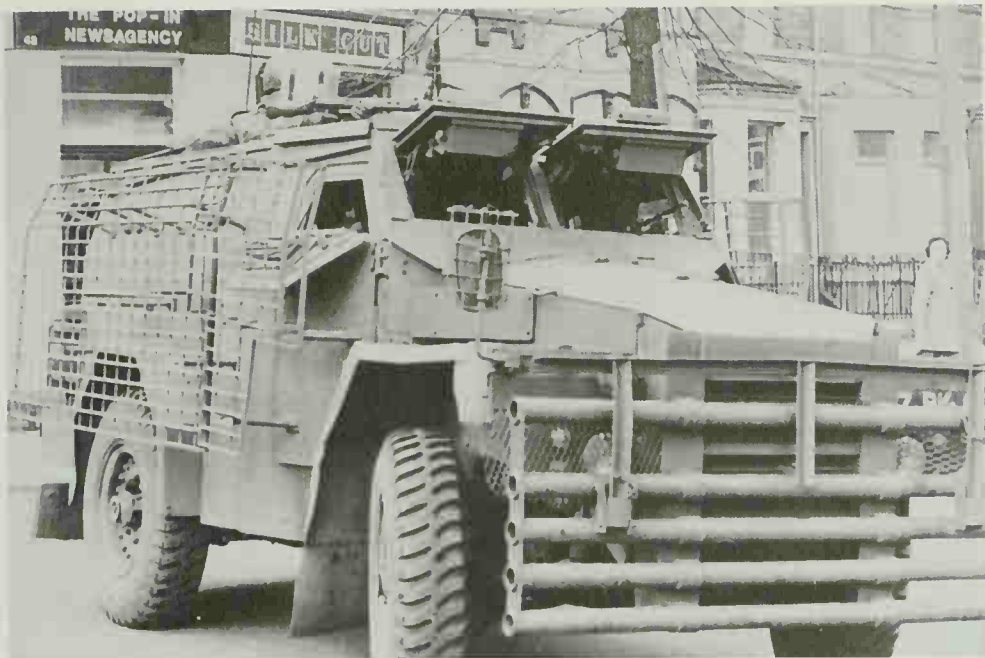
**Below:** A cut-away of the AMAC 1 IS vehicle. Special features visible in this comprehensively equipped vehicle include a retractable mast-mounted searchlight, weapon racks, water cannon and even an integral chemical toilet.





**Left:** The old Ferret Mk 5 armoured car; the machine-gun has been removed. Compare with the updated Ferret 80 shown on page 32.

**Below and right:** Some of the many guises of the GKN Sankey IS vehicle that have resulted from more than a decade of service with the British Army in Northern Ireland. Below is 'Flying Pig', in effect a mobile barricade; this is designed to be used parked with the 'wings' open to block a street and provide cover for police and troops against missiles. Note also the fender for barricade removal and the coil of barbed wire for instant barrier erection. On the right is a 'Pig' fitted with anti-rocket protection. Note also the two soldiers providing front and rear cover.



Mk 3 (modified Mk 1/1), Mk 4 (rebuilt Mk 2), Mk 5 (rebuilt of earlier vehicles).

**Employment:** Abu Dhabi, Bahrain, Brunei, Burma, Cameroon, Canada, Ceylon, France, Gambia, Ghana, Indonesia, Iran, Iraq, Jamaica, Jordan, Kenya, Kuwait, Libya, Malagasy, Malawi, Malaysia, Muscat and Oman, New Zealand, Nigeria, Qatar, Ras-Al-Khaimah, Rhodesia, Saudi Arabia, Sierra Leone, South Yemen, Sudan, Uganda, United Kingdom, Upper Volta, Zaire and Zambia.

**Data:** length 3.96m; width 2.13m; height 2.08m; ground clearance 0.41m; wheeltrack 1.75m; wheelbase 2.29m; weight 4,980kg (unladen), 5,890kg (laden); engine Rolls-Royce B60 Mk 6A 6-cylinder water-cooled petrol, developing 129bhp at 3,750rpm; crew 2; number of wheels 4 × 4; speed 80kph; range 300km; gradient 46%; vertical obstacle 0.4m; fording depth 0.9m.

### GKN Sankey IS Vehicles

**AT-104:** This vehicle was developed from the 1-tonne 4 × 4 Humber 'Pig' (FV1611) armoured truck, which is the Humber FV1601 truck chassis powered by a 120hp 6-cylinder Rolls-Royce B-60 Mk 5A petrol engine on which was mounted an armoured shell produced by GKN Sankey of Telford, Shropshire, and the Royal Ordnance Factories. The AT-100 (4 × 2) and the AT-104 (4 × 4) were produced in 1972 by GKN Sankey to meet the specific requirements of urban anti-guerrilla

operations. Utilizing Bedford civilian truck parts already in production in order to keep down costs, these vehicles are among the first to have been specially designed for this type of work.

**Variants:** The AT-104 has a number of optional items that can be fitted on request, including spotlights, a hydraulic winch, a loudspeaker system, a barricade remover, flashing beacons and/or sirens. The basic vehicle has been adapted variously, and provides a classic example of how a single machine can be modified to meet a multiplicity of different roles.

**Employment:** Brunei, Netherlands (Police); some 500 uparmoured Humber 'Pigs' are still in service with the British Army in Northern Ireland.

**Data:** length 5.49m; width 2.44m; height 2.49m (to standard cupola roof); ground clearance 0.51m; wheeltrack 1.72m; wheelbase 3.33m; weight 8,074kg (unladen); engine varies according to petrol or diesel power unit fittings, to provide power range 100–150bhp, using standard units from General Motors; crew 11; number of wheels 4 × 4; speed 80kph; range 500km; gradient 50%; fording depth 1m; maximum side slope 30%; armament in standard form is not fitted, but the cupola can be replaced in manufacture with a specially designed turret to mount single or twin MGs of 7.62mm or 5.56mm calibre; alternatively a MG can be externally mounted, and grenade launchers can also be fitted.









**Left:** The AT 105 Saxon APC. Above, a general view of the standard version, which is particularly suitable for rural IS work. It was designed as a replacement for the 'Pig' in Northern Ireland, but financial constraints have delayed its deployment there. It is however already used in the APC role by certain BAOR UK-based reinforcement brigades. Below is a specifically anti-riot adaptation, with barrier remover, 'wings' for anti-missile protection of security force personnel deployed alongside on foot, etc.

**Above right:** The Simba FS100. Note the communality of turret with the AT 105. Both vehicles are manufactured by GKN Sankey.



#### AT 105 Saxon

Designed for anti-riot requirements in urban areas and for counter-insurgency and guerrilla warfare, the standard vehicle has no fixed armament, although a turret is available if desired. The hull is resistant to 5.56mm and 7.62mm AP or ball at point-blank range. The specially shaped hull avoids mine blast pockets and affords maximum protection to the crew, engine, gearbox and radiator. Run-flat tyres are fitted as standard. Accessibility is excellent via two large doors in the rear, which are controlled by the driver, and two side doors. There are six observation/firing ports, and the driver has four small windows fitted with bullet-proof glass giving the same degree of protection as the armour plate. The same optional extra items are available as for the AT 104. The combination of good vision for crew and driver, power steering and small turning circle gives high manoeuvrability in built-up areas.

**Variants:** AT 105-E armoured personnel carrier with turret mounting twin 7.62 MGs; AT 105-P armoured personnel carrier without MG turret; AT 105-A armoured ambulance; AT 105-Q command/signals vehicle. Saxon can also be adapted to carrying and firing ATGW and medium mortars and as a recovery vehicle.

**Employment:** Bahrain, Kuwait, Malaysia (40 in service with the Army), Nigeria, Oman, United Kingdom.

**Data:** length 5.34m; width 2.5m; height 2.86m (to top of turret); ground clearance 3.3m; wheeltrack 2.06m; wheelbase 3.12m; weight 9,600kg (unladen); engine General Motors Bedford Type 500 6-cylinder diesel, develop-

ing 167bhp at 2,800rpm; crew 2+8-10; number of wheels 4 x 4; speed 96kph; range 480km; gradient 66%; vertical obstacle 4.0m; fording depth 1.12m; turning radius 8.75m; maximum side slope 36%; armament is not fitted as standard, but a pintle-mounted MG can be fitted in the command cupola; alternatively, a 7.62mm GPMG turret can be mounted.

**Simba FS100 APC:** FS100 is the latest IS vehicle from GKN Sankey. It has two side exits and double rear doors, and comes in two armour options.

**Option 1 (High Mobility):** A lightweight hull design of high-hardness ballistic steel gives immunity against 7.62mm ball rounds at any angle and any range. The shaped hull ensures survival against close-quarter attacks by 7.62mm AP rounds.

**Option 2 (High Protection):** An increased thickness hull provides complete immunity against 7.62mm AP or ball rounds fired from any distance or any angle between +40° and -10°. This option gives enhanced protection against rock and shell fragments resulting from mortar and artillery attacks.

**Variants:** FS 100/APC armoured vehicle, FS 100/AA vehicle, FS 100 20mm armoured fighting vehicle, FS 100 ATGW vehicle, FS 100/90mm armoured fighting vehicle.

**Employment:** The vehicle is now ready for production and several sales are thought to be in the pipeline.

**Data:** length 5.26m; width 2.54m; height 2.1m; ground clearance 0.33m; wheeltrack 2.07m (front), 2.12m (rear); wheelbase 2.97m; weight 8.2 tonnes; engine Perkins TV8 540 diesel, developing 210bhp at 2,500rpm; crew



**Above left:** GRP armour applied to the cab of a standard Bedford truck. The side windows are covered with Macralon armour, the front screen with a wire mesh grill.

**Left:** GRP armour on a standard Land Rover; note also the rear hatch on the roof, standard to all Land Rovers in Northern Ireland service, for mobile accommodation of two men 'riding shotgun'. Vehicles such as this are in wide use today.

**Above right:** The Glover armoured car.

**Right:** The Hotspur Armoured Land Rover, here equipped with barricade remover, loudspeaker, searchlight and CS gas dischargers on the roof.



12; number of wheels  $4 \times 4$ ; speed 100kph; range 640km; gradient 52%; turning radius 8.25m; maximum side slope 35%.

### Glover Armoured Car

Manufactured by Glover & Webb Ltd, this vehicle is designed to transport nine men including the driver and commander. It is based on the Land Rover 2.77m wheelbase 1-ton military chassis. The sides, rear and front of the body are fabricated from 6.4mm special armoured steel plate, proof against 7.62mm and .30in ball ammunition at a range of approximately 10m and providing substantial protection against AP rounds. The roof and engine compartment are constructed from 4.7mm armoured steel plate, the double-flap observation hatch in the roof being made of 6.4mm armoured steel. The floor can be armoured variously with 4.7mm aluminium or glass-reinforced plastic supplied by Bristol Composites. Observation/gun ports are provided in the sides and front and rear doors. Production is now complete.

Data: length 4.37m; width 1.65m; height 2.14m; wheelbase 2.77m; weight 2,285kg (unladen); engine 6-cylinder petrol, developing 86bhp; crew 9.

### GRP and Macralon Armour

The British Army have developed GRP and Macralon Armour for standard Land Rovers and Bedford 4-ton cargo trucks. GRP is a form of fibreglass and gives some protection against low-velocity small-arms fire, acid bombs, and Claymore fragments. GRP is used to cover the body and roof of vehicles, while Macralon, a form of strengthened plastic, is used to cover windcreens and windows.

Employment: United Kingdom.



### Hotspur Armoured Vehicles

**Armoured Land Rover:** An 'add-on' kit designed by Trevor Davies Ltd provides protection for Land Rover, Toyota Landcruiser and Willys Jeep vehicles against multi-hits by 7.62mm ball rounds at 40m. The kit can be fitted so that the normal appearance of the vehicle is virtually unaffected, and the same kit can be readily transferred to another similar vehicle in the event of mechanical breakdown. Included in the kit is a fully welded body unit, complete with seats for six persons, fabricated of 4.76mm Hotspur steel, plus rear doors (also Hotspur steel) and windscreen and side and rear windows made of 29mm laminated armoured glass. The vehicle floor at front and rear is protected by GRP laminates. Air conditioning, heavy duty





**Above:** The Hotspur Hussar, another variation on the standard Land Rover chassis, this time a rugged, simple anti-riot vehicle with all the usual fittings. This one has the added advantage of six wheels for carrying greater weights.

**Above right:** The Hotspur Sandringham 6, another Land Rover derivative. The example illustrated is configured for use in Middle East IS situations, and is particularly suitable for desert conditions.



springs and shock absorbers are fitted as standard.

**Variants:** The Hotspur Armoured Land Rover APC is the same as the Armoured Land Rover, except that it is camouflaged and is fitted with CS gas dischargers, a spotlamp, a public address system, and a barricade remover. The overall length is increased by 0.76m and the overall height by 0.56m. There is also a 6 x 6 variant.

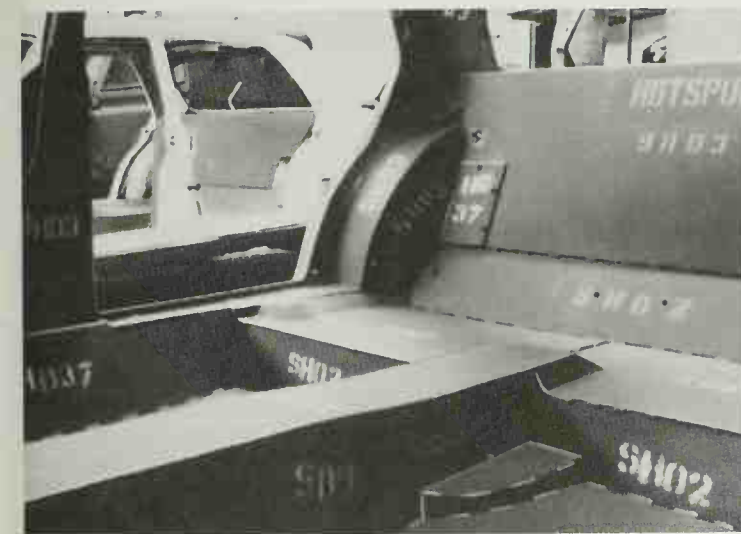
**Employment:** The Hotspur Armoured Land Rover is the basic patrol vehicle of the Royal Ulster Constabulary.

**Data:** length 4.57m; width 1.68m; height 1.91m; speed 100kph.

**Armoured Saloon Cars:** Hotspur Armoured Products Ltd, of Aberdulais in Wales, can supply customized armouring for a range of saloon cars. In many cases, the armouring system has been developed in conjunction with the vehicle manufacturer, so that the general performance of the vehicle can be retained as far as possible. The vehicle is detrimmed and, depending on the desired level of protection, high-hardness steel, ceramic, or ballistic nylon armour is fitted to the internal skin of the passenger compartment. For most applications an extremely hard steel of low alloy content is used, which will withstand multiple impact and continue to give protection against further attack. Ballistic protection can be offered up to high-velocity

rifle standard and at the highest level this forms a ballistic cell encompassing floor, roof, and all vertical surfaces with overlaps and slave plates protecting virtually all possible points of ballistic penetration including door and window apertures, locks, cable ways, etc. The original glazing is replaced with transparent armour offering protection to a level consistent with that of the opaque armour and at the higher protection levels utilizes glass/polycarbonate composites. The vehicle is re-trimmed to be virtually indistinguishable from the original trim. The same attention is devoted to the external appearance of the vehicle to ensure that the vehicle displays no obvious outward signs of having been protected. The protection levels offered range from anti-kidnap through handguns (0.38, 0.45 ACP, 0.357 magnum, 0.44 magnum using metal-piercing ammunition), 9mm sub-machine-gun, shotguns and 0.30 M1 carbine, to 7.62 and 5.56 calibre high-velocity weapons such as Enfield, Heckler & Koch, Kalashnikov and Colt M16. The range of vehicles which have been protected embraces Rolls-Royce, Range Rover, Land Rover and even heavy commercial vehicles.

**Employment:** Hotspur conversions have been supplied to heads of state, government ministers and officials, the diplomatic corps, police and military forces in many countries around the world.



**Above:** Beneath the comfortable seats of many saloon vehicles used by VIPs are layers of armour, fitted by such specialists as Hotspur. The presence of this protective armour is usually undetectable after conversion.

**Data:** As well as the armouring of the vehicle and glazing, special fittings can be added, including air conditioning, explosion-proof/self-sealing petrol tanks, run-flat wheel inserts, passenger controlled centralized door locking with anti hijack bolts on each door, engine immobilizing devices, reinforced suspension system, discreet identification lights alongside or behind the radiator grille, emergency spotlights for use if normal lighting is destroyed, distress siren or two/three-tone driving horns, automatic fire extinguishing

systems for engine compartment and boot, concealed microphone and loudspeaker system allowing communications between occupants and persons outside the vehicle without loss of ballistic protection, radio telephone or two-way radio system, smoke or gas dischargers, public address systems, hostile fire indicating systems, which through radar sensors detect and display the direction or directions from which shots are being fired at the vehicle.

**Hussar:** This is a light armoured car for IS situations. It is provided with single access doors on either side and a double door at the rear. Three gun slots and vision blocks are provided on each side of the vehicle and one in each of the rear doors. The front and side windows are glazed in transparent armour and offer the same degree of protection as the hull, which is pool against 7.6mm high-velocity ball rounds at 25m. The vehicle has an armoured monocoque hull encompassing both crew and engine compartments. A light armoured turret or rotating MG hatch are mounted on top of the vehicle. Optional equipment includes a run-flat tyre system, multiple grenade launchers, a night vision facility for the driver, a self-sealing petrol tank, spot lamps, intercom and siren and a PA system.

**Variants:** Hotspur Borderer is a 4 x 4 lightly armoured patrol vehicle built on a Land Rover 110 chassis, and is designed for a crew of three. Length is only 4.6m. The Skirmisher is the same vehicle but without a turret.

**Employment:** Hussar and Skirmisher are now in service with 5 overseas countries. The Hussar is also built under licence in Spain by IMAHO for the Spanish Army.

**Data:** length 5.74m; width 1.85m; height 2.28m (with hatch); wheeltrack 1.48m; wheelbase 3.81m; weight 5,350kg; engine Rover 3.5-litre V-8 petrol, developing 114bhp at 4,000rpm; crew 14; number of wheels 6 x 6 or 6 x 4.

### Sandringham 6 APC

In its armoured form, the S6 can be employed as a ten-man APC, radio or command vehicle or ambulance. It has the engine at the front, driver and commander are located behind the engine, and the troop compartment is at the rear. The chassis has been modified, reinforced and internally rustproofed. The body comprises a fully welded monocoque hull in high-hardness armour to defeat multi-impact from 7.62mm ball round at 40m and shell splinters. The floor armour protects against mine fragments and grenades and, being an integral part of the hull, offers good blast



**Above:** The Pyrene Water Cannon Truck, another example of a purpose-built water cannon designed for the British forces in Northern Ireland in the early 1970s. Although they have not been used recently, they remain available for deployment.

deflection characteristics. The windscreen and vision blocks are to a similar ballistic standard as the body armour. The radiator grille and engine compartment sides are also armoured. The commander and driver have side doors which open forward, and are seated on Land Rover de-luxe seats with fitted seat belts. Eight fully equipped infantrymen can be seated, four either side, and enter and leave via two doors at the rear. Locking bars are provided on all doors of the vehicle, and a grab rail runs down the centre of the roof. The floor is non-slip. Six firing ports with vision blocks, two on each side of the hull and two in the rear doors, allow targets to be engaged from within the vehicle. A Helio roof-mounted cupola, with periscope, can be fitted to accommodate a GPMG. Wheels are fitted with run-flat bands and on/off road tyres. Standard equipment includes an 80-litre explosion-proofed petrol tank with locking fuel cap, fan ventilation system, lamp guards, etc.; and a wide range of optional equipment to meet particular requirements is also available.

**Variants:** Several, of which the most suited for an IS application is the S6E-139 XLR Extra Long Range Remote Area Patrol Vehicle.

**Employment:** Finland (for UN), Sri Lanka

and an undisclosed state in the Persian Gulf. **Data:** length 4.59m; width 1.69m; height 2.06m; wheeltrack 3.18m; engine Rover V-8 petrol.

### **Pyrene Water Cannon Truck**

Designed for urban riot-control, the Pyrene Water Cannon design can be adapted to fit any suitable vehicle, and is in this case fitted to a Foden 20/40ton 6 × 4 chassis. A clean body design inhibits unauthorized mounting of the vehicle and prevents lodging of missiles, such as petrol bombs, on the structure. General construction is a welded steel framework panelled in mild steel sheets, the front of the crew compartment in 12 SWG, the remainder of the crew compartment in 14 SWG. Windscreens are in 11mm laminated glass and side windows are in 5mm Macralon. The cannon is controlled by an operator in an 11mm bullet-resistant glass cupola above the crew compartment.

**Employment:** United Kingdom.

**Data:** Performance varies according to tank capacity and pump. With cannon nozzle size 24mm, water tank capacity of 7,264 litres, water pressure is 54.4kg; throughput 1,246 litres per minute; duration approx. 5.5 minutes; effective jet length approx. 30m.



Traverse exceeds 180° and elevation/depression limits are +45°–15°. Optional equipment includes a tank containing a liquid dye concentrate, connected through suitable valves and an inductor unit to introduce a dye into the water stream en route to the cannon. A searchlight can be mounted coaxially on the cannon, and screen wipers fitted to the cupola. The screen washers can be duplicated to spray both water and paint solvent.

### Shorland Armoured Vehicles

**Mk 4 Armoured Car:** The origins of the Shorland Mk 4 go back to the mid-1960s when the Royal Ulster Constabulary asked Shorts to study the question of producing a light armoured vehicle suitable for IS and border patrol work. To meet the request for maximum simplicity and lowest possible cost, the General Engineering Division of Short Brothers & Harland of Newtownards, Northern Ireland, converted the long wheelbase version of the Land Rover by reinforcing the suspension and axles to take account of the weight of the armour, and by modifying the gear ratios. The Mk 1 produced 67hp at 4,100rpm, the Mk 2 77hp, the Mk 3 91hp at 4,500rpm and the Mk 4 91bhp at 3,500rpm. The armoured shell varies in thickness

between 8.25 and 11mm and can withstand 7.62mm NATO ammunition at close range, while the Triplex windscreen can rapidly be covered with an armoured shield fitted with vision slots. A special material based on glass-reinforced plastic is used in the floor of the vehicle, and has shown itself to afford good protection against mines. The turret is manually operated and rotatable through 360°. Searchlights and/or passive night vision equipment can be fitted.

**Employment:** Following initial deployment with the RUC, Mk 3 was issued to the British Army for use in Northern Ireland. To date the vehicle has been exported to some forty countries including Argentina, Brunei, Libya, many states in the Persian Gulf, Thailand and Venezuela. A recent purchaser of Mk 4 is the USA.

**Data:** length 4.6m; width 1.78m; height 2.29m (to turret roof); wheeltrack 1.36m; wheelbase 2.77m; weight 2,931kg (unladen), 3,360kg (laden); engine Rover 4-stroke V-8 petrol, developing 91bhp at 3,500rpm; crew 3; number of wheels 4 × 4; speed 88kph; range 514km (with long-range tank); gradient 60%; fording depth 1m; turning radius 17.75m; armament – experience has shown that preference is for the standard NATO 7.62mm

**Right:** Shorts Shorland armoured patrol vehicle, in wide use in Northern Ireland and elsewhere. It represents a simple solution to the patrol requirement and utilizes a Ferret turret. It is based on the standard Land Rover chassis, the unusually shaped rear being used for storage.





**Top:** The Shorland SB401 APC. Apart from standard IS vehicle fitments, the SB401 has comprehensive windscreen, window and firing port armoured covers.

**Above:** The Cadillac Gage V-150 Commando, here shown in its police configuration, with flashing light and searchlight clearly visible.

GPMG, although a variety of armament can be mounted.

**SB401 IS APC:** Developed from Mk 4, this vehicle is intended as a practical and cost effective solution to the safe transport of personnel under operational conditions in an IS situation. With the same engine and mechanics of the Mk 4 and a similar performance, SB401 can carry eight men, two of whom travel in the front. Protection is similar to that of the Mk 4 and is effective against 7.62mm at short range. The roof is ridged to ensure that hand-thrown missiles roll off when the vehicle is stationary.

**Employment:** Netherlands (Airport Police), United Kingdom (RUC); twenty vehicles have also been ordered by two other countries.

**Data:** length 4.29m; width 1.77m; height 2.16m; wheeltrack 1.36m; wheelbase 2.77m; weight 3,545kg (laden); engine Rover 4-stroke



V-8, developing 91bhp at 3,500rpm; crew 8; number of wheels 4 x 4; speed 104kph; range 368km; gradient 50%; fording depth 1m; turning radius 17.75m.

## UNITED STATES OF AMERICA

### Cadillac Gage Armoured Vehicles

**Commando V-150 APC:** A prototype of the Commando was produced in March 1963 and it went into production in 1964. The Commando uses many components already in use in other vehicles, such as the Rockwell Standard axles used in the M-34 series of trucks and the 210hp Chrysler V-8 engine used in the M-113 APC. The Commando, which proved itself in Vietnam, has excellent mobility with a high top speed, a good range, and can carry 12 men. It offers good protection against inflammable liquids and close-range small-arms fire, and individual weapons can be fired through ports.

**Variants:** There are four different models of hull: V-100, V-150, V-200 and V-300. The V-100 is the basic version, while the V-150 has stronger suspension and axles and can be fitted with a different engine and transmission. The V-200 is powered by a 275hp diesel. All versions are available in a wide range of configurations, of which three are suitable for IS duties: the simple turretless APC, the turreted version and the fixed superstructure version which can be used as a mortar or command vehicle.

**Employment:** Bolivia, Botswana, Cameroon,



**Above:** The Cadillac Gage Commando Scout is the latest in the line of Commando armoured cars. It is well suited to IS reconnaissance work, being equipped with grenade launchers, searchlight and twin machine-guns.

Dominican Republic, Ethiopia, Gabon, Guatemala, Haiti, Indonesia, Jamaica, Kuwait, Laos, Lebanon, Malaysia, Mexico, Muscat and Oman, Panama, Peru, Philippines, Portugal, Saudi Arabia, Singapore, Somalia, Sudan, Turkey (Police), USA (Air Force, Army and various state police forces). To date, more than 4,000 of these vehicles have been sold.

**Data:** length 5.69m; width 2.26m; height 1.96m (to hull roof); ground clearance 0.38m; wheel-track 2.1m; wheelbase 2.85m; weight 6,804kg (unladen), 9,185kg (laden); engine Chrysler 361 210hp petrol or Cummins V-6 155hp diesel; crew 12; number of wheels 4 × 4; speed 90kph; range 750km; gradient 60%; vertical obstacle 0.61m; swims; turning radius 16.7m; maximum side slope 30%; armament externally mounted MG or manual turret mounting twin .30 7.62mm/.30/.50 combination MGs.

**Commando Scout:** Designed as a reconnaissance vehicle, Scout is suitable for both conventional and IS situations. It is a highly agile, low-silhouette vehicle suitable for operations in open terrain or, with its small size and turning radius, it is equally at home in an urban environment.

**Variants:** Command vehicle with 7.62mm MG mount; turreted version mounting twin .50 or 7.62mm MG; turreted version with 40mm/.50 MG; Scout with TOW missile system; and 20mm turret.

**Employment:** Negotiations are in hand with several customers.

**Data:** length 2.5m; width 2.06m; height 2.16m; wheelbase 2.67m; weight 6,800kg; engine V-6 diesel, developing 149bhp at 3,300rpm; crew

2-3; number of wheels 4 × 4; speed 55mph; range 500 miles; gradient 60%; vertical obstacle 0.61m; fording depth 1.17m; turning radius 7.8m; maximum side slope 30%; armament twin 7.62mm MG, combination 7.62mm/.50 MG or 7.62mm/40mm grenade launcher.

**Commando Ranger:** Designed to provide good ballistic protection and high mobility at low cost, this simple, rugged and effective vehicle offers crew protection against small-arms fire and grenade fragments by using Cadillac Gage lightweight Cadloy armour, which holds the vehicle weight to 4,536kg.

**Variants:** APC, command vehicle, ambulance and Ranger with MG turret.

**Employment:** UA Air Force, US Navy, Indonesia, Luxembourg.

**Data:** ground clearance 20cm; weight 4,536kg; engine petrol V-8 developing 180hp; crew 8 (APC configuration), 3 (turret configuration); number of wheels 4 × 4; speed 113kph; range 490km at 72kph; gradient 60%; vertical obstacle 25cm; maximum side slope 30%; armament 7.62mm MG, twin 7.62mm or one 7.62 mm with .50 cal turret.

## USSR

### BTR-152 APC

This vehicle first appeared in 1950 and was based on the ZIS-151 truck chassis; later models used the ZIS-157 chassis. It is the most widely used of Soviet vehicles in IS situations. Although no longer in service with the Soviet Army, the vehicle is still used for IS duties.

**Variants:** BTR-152V (with variable tyre pressure system), BTR-152K (with overhead armour), BTR-152U (command vehicle) and the BTR-152V (with twin 14.5mm guns).

**Employment:** Afghanistan, Albania, Algeria, Cambodia, Ceylon, China, Congo, Cuba, East Germany, Egypt, Guinea, Hungary, India, Indonesia, Iran, Iraq, Israel, Mongolia, North Korea, North Yemen, Palestine Liberation Army, Poland, Romania, Somalia, Soviet Union, Sudan, Syria, Tanzania, Uganda, Yugoslavia.

**Data:** length 6.55m; width 2.31m; height 2.01m; ground clearance 0.31m; weight 8,950kg (laden); engine ZIS-123 6-cylinder in-line petrol, developing 110bhp at 2,900rpm; crew 17; number of wheels 6; range 644km; gradient 55%; vertical obstacle 0.6m; fording depth 0.8m; armament one 7.62mm SGMB MG.



# Helicopters in the IS Role

Helicopters are particularly suited to IS operations. None has been specifically designed for IS work, but virtually all military and some civilian helicopter types have at some time taken part in IS operations. In a rural environment they are used for placing quick-reaction forces in cut-off or ambush positions. They are particularly suitable for mounting what the British Army in Northern Ireland call 'Eagle' patrols – the technique of swooping down on a country lane, dropping a small party of soldiers and mounting an instant road block for a limited period. The helicopter loiters nearby until the road block party recalls it. In a rural environment, helicopters are particularly useful for surveillance duties, liaison and logistic support. In many IS situations, security force

bases are dangerous and difficult to reach by road. If a large convoy is used for resupply purposes, its route has to be cleared and picqueted, a time-consuming and manpower-intensive pastime. Clearly the simplest and most efficient method of routine supply and liaison for such outposts is by helicopter, and this is the method normally used by the British Army to resupply its bases in South Armagh in Northern Ireland.

In an urban environment, helicopters are of more limited use but can be used in the crowd surveillance and control roles with searchlights, camera or loud-speaker equipment. They can also be used as mobile command posts. Indeed, there are occasions, particularly in a confused urban situation, when the



only way a commander can get an overall impression of a situation is from the air. Finally, and perhaps most important, helicopters are used in IS situations for casualty evacuation. Many lives have been saved in Northern Ireland and elsewhere by flying grievously wounded soldiers direct to a hospital helipad. Certainly in Northern Ireland all the main casualty hospitals have helipads.

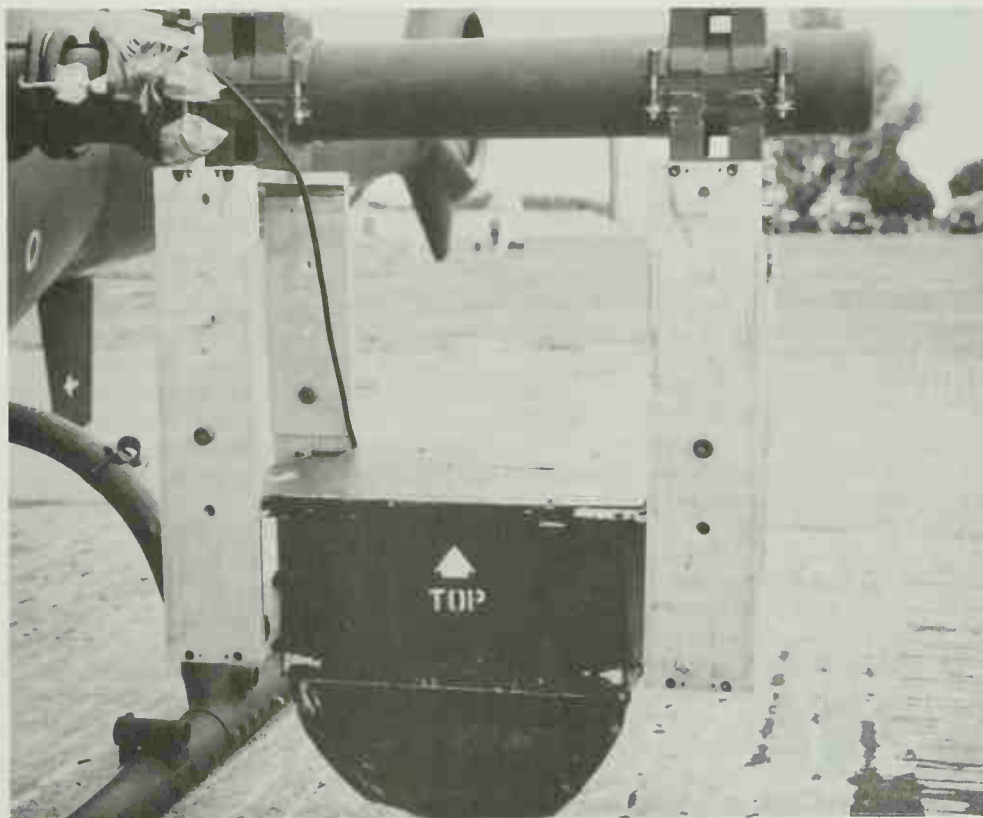
Helicopters have remained remarkably immune to small-arms fire – their tolerance to several hits is considerable. While some have been forced to land at the first opportunity by damage caused by small-arms fire, few have been ‘shot down’. Where, however, terrorists or guerrillas have managed to obtain hand-held surface-to-air missile systems, such

as the Soviet designed SAM-7, helicopters have been successfully engaged. There is photographic evidence of successful engagements of Soviet helicopters in Afghanistan by the Mujahadin. The counter to the SAM-7 is to fly at 50 feet or less, so that the SAM-7 operator does not have sufficient time to acquire his target, fire the missile and achieve lock-on with the infra-red heat-seeking system during the brief exposure time of the target.

It is not the aim of this short chapter to catalogue all the world’s military helicopters: indeed, it is not intended to illustrate any military helicopter *per se*. Rather, it is to provide some examples of specifically IS attachments to helicopters, so as to illustrate how helicopters have been adapted to IS situations.

**Left:** A scene from an anti-terrorist exercise in which SAS troops land from a hovering helicopter to blast their way into a hijacked airliner. This particular tactic might be more suitable for follow-on forces.

**Right:** Aerial photography is a vital tool in IS situations. Suspect bombs can be photographed for remote analysis by ATO, and illegal gatherings can be recorded for identification of ringleaders. This camera mounting is designed for a British Army Air Corps Gazelle helicopter to house a Zeiss camera.





**Above:** An armoured seat for fitting in a Puma helicopter. Note the bucket-seat shape, affording protection from three sides.

**Above right:** Torso protection for helicopter pilot. Because of the multi-directional nature of the threat, pilot protection tends to be more fully wrap-around than conventional body armour.

### Pilot Protection

Helicopters can survive a remarkable number of bullet strikes to the airframe, but clearly the same cannot be said of the pilot. Armoured helicopter seats are made by most aircraft-manufacturing nations, mainly for military purposes; however, their use is particularly relevant to the IS helicopter. An example is the range of ceramic/fibre composite armour made by Bristol Composites. The armour, which can be designed to fit inside an existing crew seat or can be bolted on to the seat exterior, is available in a number of different grades. The heaviest is capable of stopping multi-hits of 7.62mm AP ammunition from an FN FAL rifle at 90m range. Crew members can also be provided with breast-plates of similar material – the pilot is vulnerable to a round entering the front of the aircraft.

### Night Vision and Navigation Aids

**Night landing aids:** To effect a rendezvous between security forces and a helicopter, a



relatively compact and simple system of homing-in is needed. The 'Pal' range of night landing aids developed by Security Research Ltd provides an example. It consists of an angle of approach indicator and tactical approach lights; the standard system is one indicator and 5 lights. It comes in a carrying case complete with a charger unit.

**Thermal imaging:** The helicopter pilot will need equipment for enhancement of night vision, such as the LT1069 Helicopter Thermal Imaging System developed by Lasergage and Barr & Stroud. Compact and lightweight, this has been specially developed for helicopter use; it is completely passive, operates independently of ambient light levels and sees through mist, smoke and glare from the sun, flares or searchlights. The thermal imager is mounted via a gimbal and yoke mechanism, the controls and display being mounted within the helicopter.

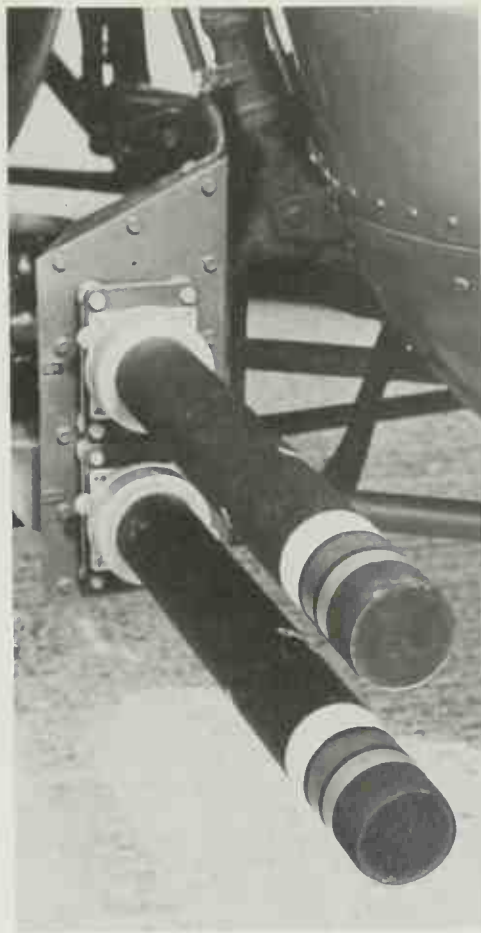
**Flares:** Unlikely in a conventional war situation is the need to provide illumination of an area of ground. However, in IS operations





**Above:** The Lasergage LT1069 Helicopter Thermal Imaging system, a remotely controlled infra-red night vision device, which is mounted on the underside of the aircraft.

**Above right:** A pair of 2in Mk 5 emergency flares from Schermuly mounted on a helicopter airframe – a simple and basic means of providing instant white light over a limited target area.



illumination of terrorists may be required. This can be achieved by use of flares, such as the Schermuly Mk 5 emergency flares, twin-mounted to helicopter airframe.

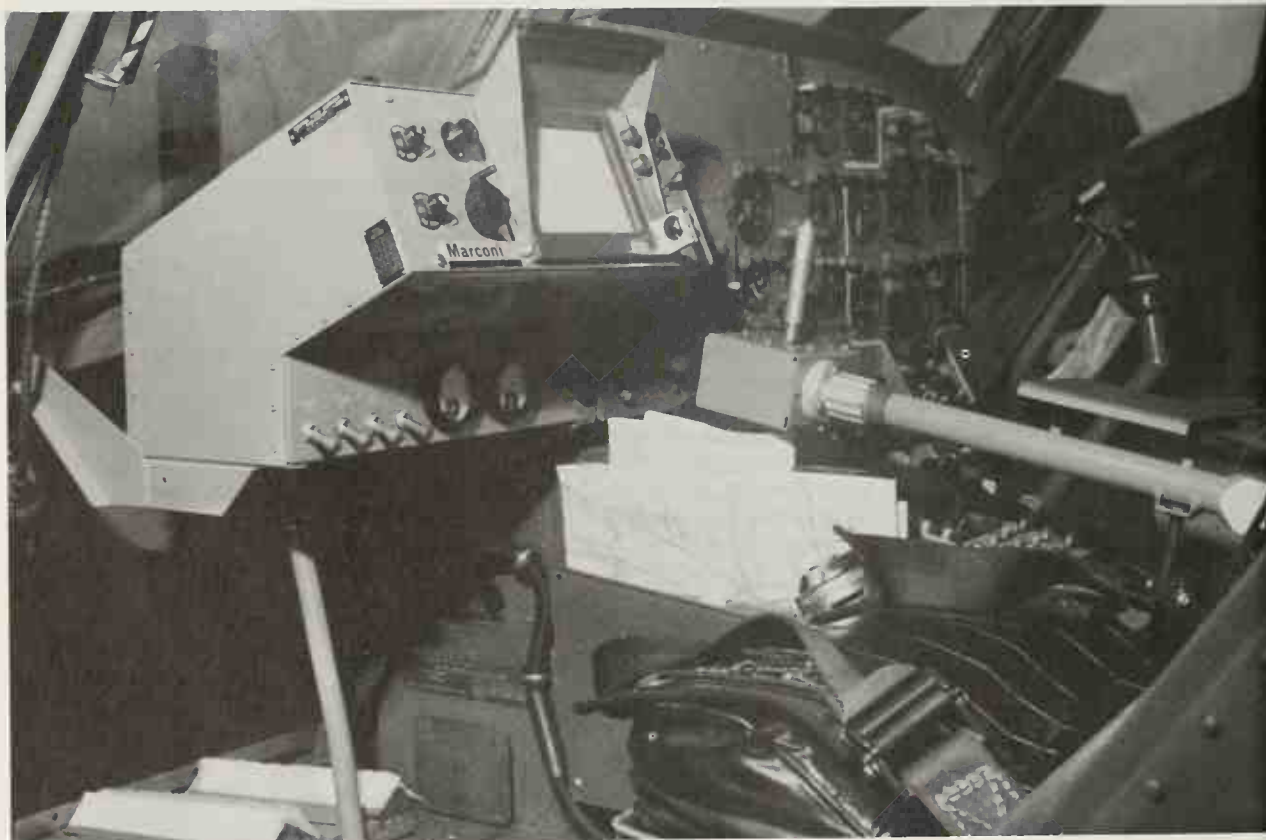
**Searchlights:** More durable high-intensity illumination requires a searchlight. One such is Spectrolab's SX-16 Nightsun. Developed by Spectrolab of California, this is a lightweight high-power searchlight. The Nightsun's brilliant but accurate beam is an ideal aid in an IS situation – it can be directed by the operator to illuminate those areas he wants lighted, without creating secondary disturbances in surrounding areas. The high power of the searchlight allows helicopters to fly at higher altitudes, thus avoiding small-arms fire. When equipped with a special IR filter, Nightsun may be used to observe activities at night without a terrorist knowing the beam is directed at him.

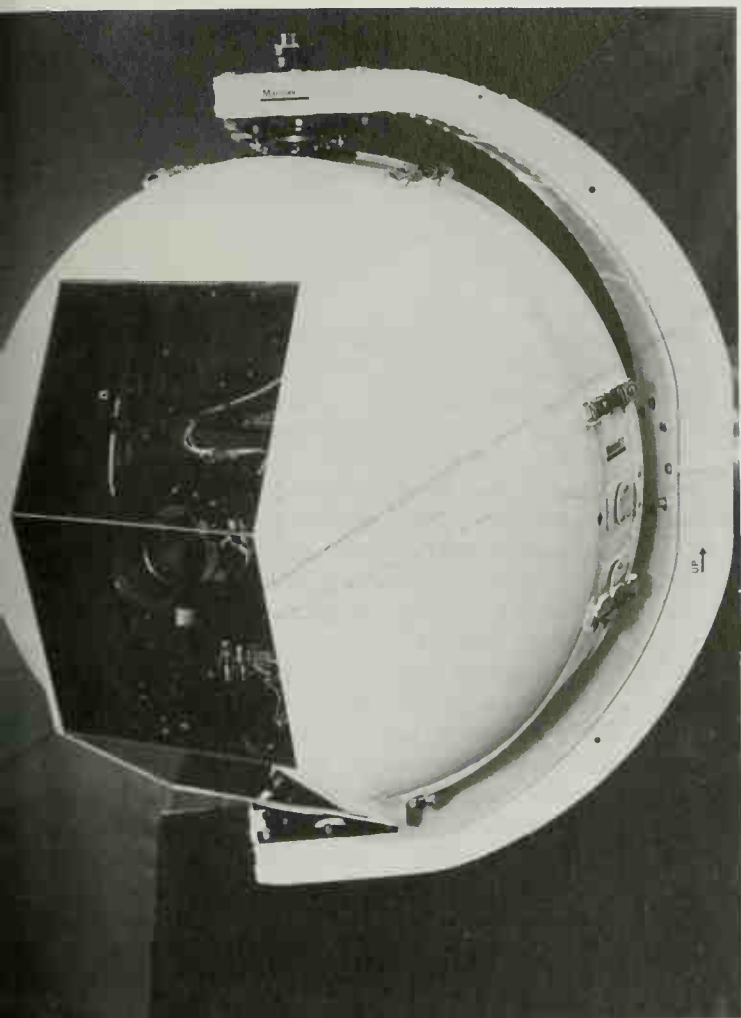
**Employment:** Various US police forces (fitted to Bell Jetranger), British Army Air Corps (fitted to Scout Helicopter and used in Northern Ireland), and other police forces.

**Data:** *dimensions* 27.9cm × 45.7cm (remote-control unit 15.2cm × 10.1cm × 7.2cm); *weight* 11.34kg (remote-control unit 0.85kg); *beam spread* 4° in search mode, adjustable to 20° in flood mode; *beam intensity/size* 50× bright moonlight at 1,000m for 100m diameter beam; *average beam power* 25,000 Lumens.

### Marconi Elliott Heli-Tele

The Electro-Optical Systems Division of Marconi Elliott Avionics Systems has developed the remarkable air-to-ground television surveillance and reconnaissance system known as Heli-Tele. It consists of a colour television camera mounted on a helicopter, a microwave link with multi-range aerials and a number of display units both in the helicopter and at base headquarters. Of cardinal importance in the operation of the system is the stabilized platform on which the camera is mounted. The platform stabilizes the camera along its line of aim to better than 1/1600th of a degree and isolates the camera from the

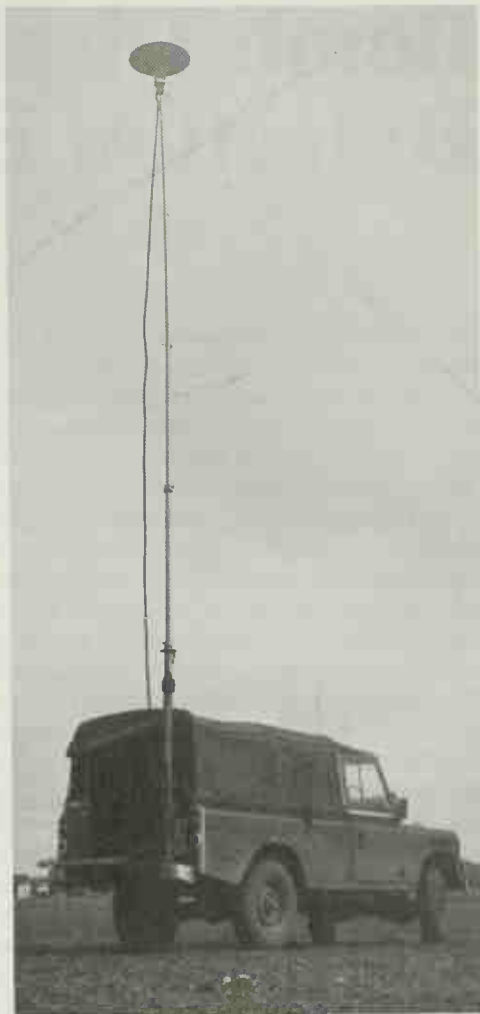




**Left:** External and internal views of the Heli-Tele system fitted to a Scout helicopter.

**Above:** The sensor ball version of Heli-Tele, which is mounted on the side of the Lynx helicopter in Northern Ireland for surveillance purposes.

**Above right:** A Heli-Tele mobile ground station with the aerial erected; note that erection requires supporting stays. The monitors supply real-time information to the commander on the ground.



vibrations and positional changes of the helicopter. The camera attitude and its zoom lens are controlled from a joystick with a two-axis movement. The camera's field of view extends down to about  $1^\circ$ , which enables the pinpointing of subjects from very considerable distances. Although a monochrome camera may be employed, the use of a colour system enhances not only the general monitoring of subjects but also the differentiation between subjects of a similar type. If a low-light camera tube is fitted, surveillance under starlight conditions is possible. The advantages of Heli-Tele are immense for reconnaissance and surveillance in urban, rural and offshore areas. Unit commanders can rapidly survey and search large areas by operating a number of helicopters simultaneously relaying pictures back to centralized monitors and videotape recorders. They can develop their strategy based on what they can see rather

than what they are told and deploy their men and equipment immediately to counter a rapidly changing situation. The short range ground station is transportable and can be unloaded and set up by two men in less than ten minutes in any convenient building or in the open air. It can also be fully mobile in a vehicle such as a Land Rover, either stationary with the antenna erected or on the move with the aerial down. This concept of the short-range ground station is complementary to the command post installations and allows multiple simultaneous reception of the aircraft television transmissions by a number of mobile or stationary ground receivers.

**Employment:** Belgium (Gendarmerie), United Kingdom.

**Data:** weight 150kg; field of view  $1^\circ$ – $20^\circ$ ; elevation  $+25^\circ$ – $-60^\circ$ ; transmission link range 4–6km (short range station), 40–60km (long range station).



# Bomb Disposal and Detection Equipment

One of the most widely used terrorist weapons is the bomb. Bombings are aimed at military targets (vehicles or soldiers) or economic targets; or they can be indiscriminate. The rationale behind an attack on a military target is clear enough. That against an economic target incorporates a longer term strategy and is designed to undermine the ability and determination of the state to carry on the war against terrorism – clearly, the more expensive a campaign becomes the more difficult it is to justify to the taxpayer in a democratic state. The IRA in Northern Ireland have quite regularly bombed factories and other economic targets. Indiscriminate bombing is, perhaps, terrorism in its purest form. By creating an atmosphere of terror indiscriminately it is hoped to so terrify and intimidate the population that they will be cowed into submission. Bombing of aircraft, of shopping precincts, of hotel lobbies and of airport check-in facilities are but a few of the many public places that have been bombed by the Red Army Faction, the Bader-Meinhof group, Palestinian terrorists, Sikh extremists, the IRA and many other terrorist groups in recent years.

The nature of terrorist explosive devices varies according to the nature of the planned target and the skill of the bomber, and may therefore incorporate commercial or home-made explosive materials and be initiated by command detonation, a timing device or target influence. Perhaps the most common method of transporting and placing a bomb is by using a car. The so called 'car bomb' has become almost commonplace as a method of terrorist attack throughout the world. In the Lebanon in 1983–4 even larger amounts of explosive were packed into lorries and driven by suicidal Palestinians straight at buildings occupied by US and French troops of the four-power peacekeeping force. The method proved horrifically effective when 241 US marines were crushed to death in their collapsed barrack block. A variation of the car bomb is the so-called 'proxy' bomb, a technique developed by the IRA in Northern Ireland whereby terrorists intimidate (usually by holding the victim's family hostage under

threat of death) an individual to drive a car bomb up to a target and leave it there. 'Proxy' bombs are normally activated by means of a timing mechanism. This is sometimes associated with a telephoned warning, which allows the security forces to evacuate innocent civilians. This technique causes maximum disruption and damage while at the same time giving the impression that it is not the terrorists' wish to harm anyone.

The Command Wire Improvised Explosive Device (CWIED) and Radio Controlled Improvised Explosive Device (RCIED) are the most difficult to guard against. The first requires the individual initiating the bomb to be at the end of a wire and to be able to see the target. The second provides the bomber with great flexibility, but it also requires more sophisticated initiation equipment. Much research is going into ways of countering the RCIED. The third main category of initiation of an explosive device is target influence, whereby the presence of the target initiates a trembler or similar device. Vigilance, good tactics and timely intelligence remain the best defence against such a threat.

One of the most horrific examples on the British mainland of command detonation was on 20 July 1982, when, shortly before one o'clock, a bomb exploded underneath the Bandstand in Regent's Park, London, upon which a military band was playing. Six members of the band were killed instantly and one died later of his wounds. A few hours before, men of the Household Cavalry mounted squadron had been cut down by a car bomb as they rode through Hyde Park on their way to ceremonial duties in Whitehall. Nobody will ever forget the horrific photographs of men and horses lying stricken in the road.

The twin atrocities of the assassination of Earl Mountbatten on his boat Mullaghmore in the Republic of Ireland and the Warrenpoint explosion, which killed 12 paratroopers, occurred on 27 August 1979. The former was probably detonated remotely from a vantage point on the shore, the bomb being

50 pounds of explosives hidden beneath the boat's decking; the latter, 500 pounds of explosives in milk-churns hidden in hay bales, was detonated by men just across the border, as the paratroopers' truck was passing.

Another method of delivering high explosive to a target much favoured by the IRA in Northern Ireland is the home-made mortar. Guerrilla movements all over the world have used mortars to attack targets remotely but have usually been able to acquire properly manufactured mortar systems, either from the international arms market or by acquiring them in action from government troops. In Northern Ireland it has proved too difficult for the IRA to smuggle such bulky weapons into the country. Moreover, their sophisticated sighting systems make them unnecessarily complicated for the IRA's simple requirement – to lob high-explosive a short distance into a security force base. Ingeniously, the IRA has developed a series of home-made mortars, which, although unreliable and unpredictable, have sometimes managed to inflict casualties inside security force bases.

A distinction that should be made clear is between a bomb designed to cause maximum damage to buildings or military vehicles and one that is targeted against an individual. The former often consists of hundreds of pounds of explosives and can be secreted in a vehicle or large container (a beer keg or milk churn) and placed behind a wall or under a culvert. They can be detonated either remotely or by means of a timing mechanism. The second category of bomb is altogether a smaller, and often more sophisticated affair, which can be attached to the underside of a car, to a door or even delivered by post. It is a common terrorist tactic to place bombs underneath cars or in the engine compartments of cars belonging to members of the security forces during the night, so that when they drive them away next morning a trembler device detonates the explosive. This method was used to murder Airey Neave, a British Member of Parliament, in 1979 as he drove away from the House of Commons car

park. The third main category of bomb is the incendiary. This is an even smaller device, which can be placed easily under inflammable materials in a warehouse or shop, with a small timing device attached to it. The device bursts into flame for long enough to start a fire in the target building.

Bomb detection and disposal has developed as an art since the early 1970s. The British Army, like other major armies of the world, already had Explosive Ordnance Disposal (EOD) personnel before the Emergency in Northern Ireland witnessed the introduction of the terrorist bomb in large numbers in 1971. They were mostly employed in disposing of Second World War German bombs. These teams, formed from the British Army's Royal Army Ordnance Corps and Royal Engineers, have various detection and disposal aids available to them. In particular, remotely controlled vehicles capable of carrying and operating a variety of equipment necessary for the location and disposal of dangerous objects have been developed. These vehicles enable the Ammunition Technical Officer (ATO) to remain at a safe distance while he locates, identifies by TV camera and monitors a suspected bomb. If he decides that the object is too dangerous to be approached, he can attempt to disarm or destroy it by using various aids on the vehicle. Perhaps one of the best known of these remote EOD vehicles is Wheelbarrow, which has been developed and refined since the early days of the Emergency and which continues in use today. It has a wide variety of 'add-on' elements so that the system can be adapted to deal with different types of target. Among its many attributes, Wheelbarrow has the ability to deal with petrol tankers, a favourite target of IRA bombers. It has a close-circuit TV camera and monitor to allow remote surveillance, lights to illuminate the target and a shotgun to disrupt the firing mechanism of an explosive device. Over the years, Wheelbarrow and other systems like it have saved many bomb disposal experts' lives.

In many instances, a manual approach is necessary, either to prevent blast damage or because

forensic evidence is required. In such a case the ATO will wear an EOD suit, which is designed to give some protection against fragments, blast and flames during the disarming of improvised explosive devices (IEDs). It will also provide a measure of protection at greater range against larger devices. If a manual approach is made, the ATO will carry an inspection set consisting of probes, extension rods, mirrors, magnets, lock viewers and hooks and line. All these components must be made up of non-ferrous metals. Although remotely controlled vehicles are the safest method of dealing with explosive devices, manual approaches are often necessary.

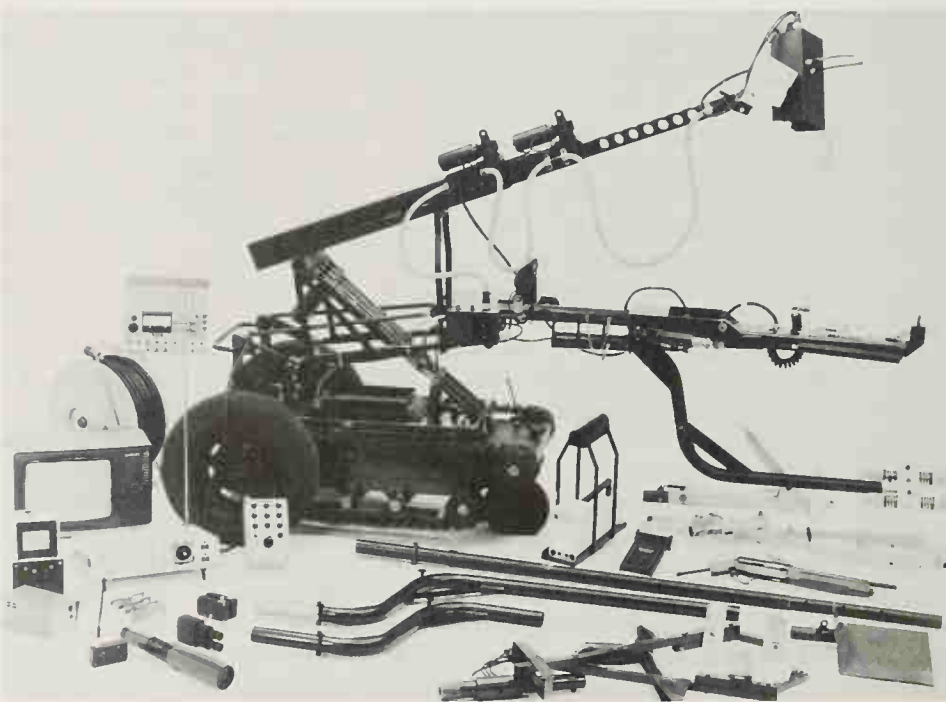
Prevention by early detection is preferable to disposal later. Although most disposal equipment is manufactured in either the United Kingdom or the USA, detection equipment is designed and manufactured in Belgium, Canada, Finland, Germany, Switzerland, the UK and the USA. One of the main tasks of troops and police engaged in IS duties is the checking of vehicles and their occupants at vehicle check points (VCPs). Another frequent task is the searching of houses and waste ground. In the same way, airport security personnel have to keep a constant watch for attempts by terrorists to smuggle IEDs or weapons on to aeroplanes. Various equipments have been developed to detect metal objects and explosive substances on the person or in luggage. Most explosives 'sniffers' will positively

identify and indicate the presence of gelignite, dynamite, nitro-glycerine, nitro-benzene, DNT, TNT, RDX, PETN and other explosives.

Equipment apart, the ordinary soldier probably accounts for the greatest number of finds by using his eyes and common sense. Major successes have also been achieved by trained 'sniffer' dogs and their handlers. Search techniques in a rural environment largely involve having an eye for the ground. Clearly it is not possible to search large areas of countryside comprehensively; it is necessary to put oneself in the mind of the individual hiding the arms, ammunition or explosives. Normally, anyone hiding something in the countryside will choose a suitable marker, such as a lone tree or a particularly prominent track junction. Often a search in the vicinity of such a 'marker' has produced results. Farm outbuildings, manure or silage heaps and culverts are popular hiding places. In buildings, any attic, floorboard or the inside of a false wall can accommodate an illegal weapons cache.

This chapter covers a range of equipments in the bomb disposal and detection field, including remotely controlled bomb disposal vehicles, bomb blankets, inspection sets, explosives 'sniffers', metal detectors and airport X-ray equipment. Conventional mine/metal detectors for use on the ground are not included, although these are used in rural IS situations. EOD suits will be found in the chapter on Body Armour.

**Right:** The Hunter Remote-Control EOD vehicle, one of a number of specialist miniature vehicles that have been developed to enable bomb disposal operatives to examine and neutralize explosive devices at a safe distance. This illustration shows the considerable array of special attachments now available on such machines; they include disruptors, shotgun, camera equipment, TV monitor, telescope, cable and drum for extended remote use, extension arms for added reach and various other remote handling devices.





## BELGIUM

### Balteau Detection/Inspection Equipment

**Bactobloc X-Ray Equipment:** The Bactobloc SPO70 is a simple and complete radioscapy equipment developed by Balteau of Beyne-Hensay for the rapid inspection of objects and packages. The Bactobloc SPO70 (and the larger SPO100 model) are mainly suitable for the examination of light metals, plastics, organic materials, aluminium, electronic components, integrated circuits, wood, rubber, paper, small animals, etc. This equipment is primarily designed for the inspection of packages and mail addressed to ministries, embassies, banks, prisons, etc., although it has other uses in factories and laboratories.

**Variants:** The Bactobloc SPO120, 140, 160 and 200 models are designed more specifically for the examination of denser materials, such as ceramics, castings, welds, explosives, etc.

**Data:** weight 98kg; depth 60cm; width 48cm; height 40cm; chamber aperture 50cm × 32cm.

**Postix Letter Bomb Detector:** To examine mail, it is only necessary to insert an envelope through a lateral aperture and then observe its radioscopic image on a screen. When in use the equipment is placed on a table, where it occupies not much more space than a typewriter. It comprises a small X-ray generator, a

radioscapy system, with screen and observation eye-shade, and a small motorized manipulator controlled by the operator.

**Employment:** Belgium and elsewhere in Europe.

**Data:** weight 70kg; depth 54.6cm; width 50.6cm; height 45cm; mail aperture 5cm × 27.5cm.

## CANADA

### Leigh Marsland Explosives Detectors

**Model S201:** This equipment is designed to sense vapours from a broad range of civil and military manufactured explosives. Powered by rechargeable nickel-cadmium batteries, the 10kg main unit can be carried by hand or on a back pack. Audio and visual alarms are provided.

**Employment:** Canada.

**Data:** weight 11.8kg; depth 43.4cm; width 33.2cm; height 15.2cm; probe depth 21.6cm; probe width 13cm; probe height 10.2cm; response time 3 seconds; gas supply gives 60 hours continuous use.

**Model S301:** This device detects explosives hidden on a person's body or clothing. As the individual passes through a doorway, a curtain of air sweeps vapours from the body and into the detectors, any one of which will detect the

**Right:** The Leigh Marsland Explosives Detector Model S201. Most explosives emit vapour, and equipment such as this are designed to detect and analyse them.





**Above:** Finland's Outokumpu Metor Weapons Detector. Outokumpu are particularly adept at making what may be considered a sinister piece of equipment appear harmless and everyday by clever ergonomic design.

**Above right:** The Metor 118, a standard metal/weapon detector in use in many airports throughout the world.



presence of explosives. To function reliably, the individual should pause for three seconds in the air curtain. This device requires six seconds to process an individual; a hand held detector requires 20–50 seconds.

**Employment:** Canada. These equipments are no longer in production.

**Data:** weight 249kg; depth 76.2cm (excluding ramps); width 1.83cm; gateway width 68.6cm; overall height 2.03cm.

## FINLAND

### Outokumpu Metor Weapons Detector

Outokumpu Electronics of Espoo has developed a highly successful weapons detector designed primarily for use at airports. When a metal object causes an alarm, a red lamp will light up either on the front panel of the cabinet or on a remote visual alarm display unit. The alarm signal can also be used to activate door locks. The system sensitivity is variable, this determining the minimum size of object to be detected.

**Employment:** The equipment is in use mostly

at airports, but also in other roles in Angola, Argentina, Canada, Denmark, Finland, Greece, Hungary, Iran, Italy, Jordan, Luxemburg, Malawi, Netherlands, Nigeria, Norway, Saudi Arabia, Spain, Switzerland, Taiwan, Tanzania, the USA, and Venezuela. Over 4,500 units have been installed worldwide.

**Data:** weight 14kg; coil weight 270kg; cabinet depth 35cm; cabinet width 50cm; cabinet height 18.5cm; maximum coil depth 2.35m; maximum coil width 1.27m; maximum coil height 2.3m.

**Metor 118:** This improved model incorporates sixteen switch-selectable timing programs for different security requirements; the manual sensitivity adjustment is under a lockable cover.

**Variants:** A weather-proof model is available for outdoor installations; it can be operated with a standard or weather-proof electronics unit.

**Data:** operating temperature range 0–55°C; gate height 2.18m; gate width 0.87m; gate depth 0.51m; weight 44kg; electronics unit dimensions 0.14m × 0.41m × 0.26m; electronics unit weight 11kg.



**Above and right:** The German Ferex 4.021 Search Instrument in use; the equipment can detect mines and bomb-making equipment in most environments including under water. Its variety of probes make it valuable for IS applications.

## GERMAN FEDERAL REPUBLIC

### Institut Dr Forster Ferex 4.021 Search Instrument

The Ferex 4.021 is more than a conventional mine detector, and is particularly suitable for IS conditions. The probe can be used with or without the carrying tube, and also for searching underwater up to a depth of 30m. The device measures the degree of interference caused by a ferro-magnetic object by means of a differential-field measuring arrangement.

**Employment:** German Bundeswehr.

**Data:** carrying case 1.11m × 14.5cm × 27cm; power supply unit 9.5cm × 5.5cm × 31.5cm; control unit 9.5cm × 10cm × 26cm; probe tube 60cm long, 4.6cm diameter; carrying tube 1.035m long; weight 4.5kg; locating range 6m.

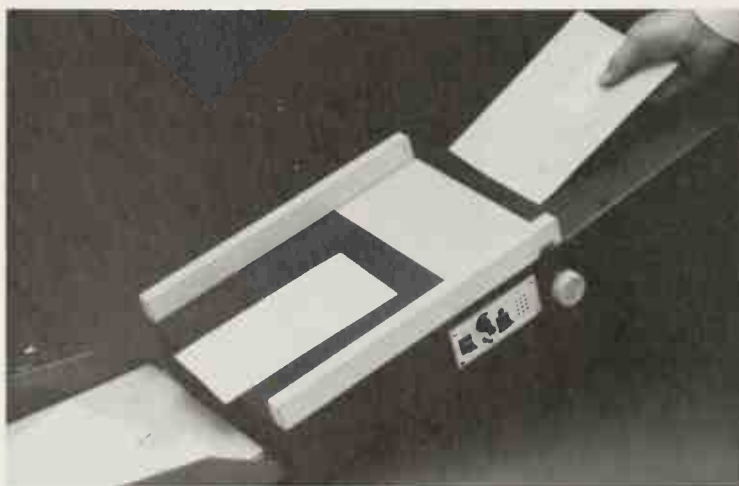
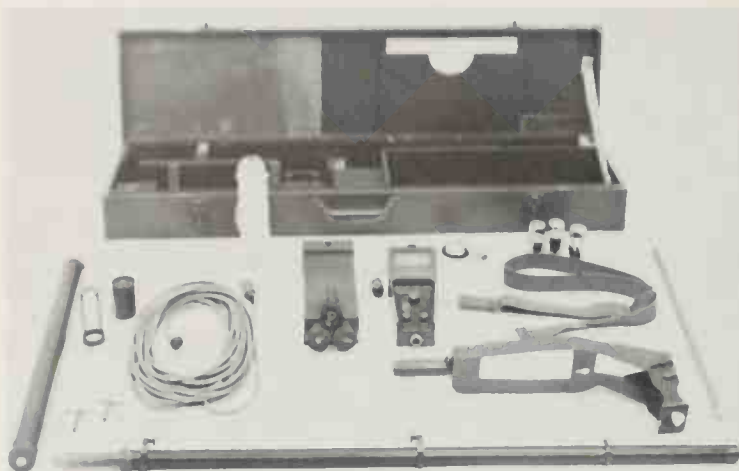
### Vallon Bomb/Metal Detectors

#### Electronic Bomb Detector Model MB 1710A:

This equipment consists of an oscillator, measuring amplifier, automatic zero compensator, power amplifier, sensitivity adjuster, function selector, pilot lamp and audible alarm loudspeaker, all integrated into a lam-







minated plastic box. The acoustic signal will sound if the letter or parcel contains any suspicious metal components such as copper wires, strikers, mechanical time-fuse devices or batteries necessary for the detonation of a bomb.

**Data:** sensor zone 220mm × 220mm; voltage 220V/50cps; alarm acoustic signal 500–2,500cps; weight 5kg.

**Metal Detector Models MH 1603, MH 1604 and MH 1607:** The MH 1603 and 1604 were developed to provide security forces with a convenient metal detector capable of performing checks on persons and packages. They have been used to detect ammunition hidden in tree-trunks, hedgerows, behind walls and other similar hiding places. MH 1607 is used for screening of envelopes in order to locate pieces of wire, mine ignition systems and other metal parts. The concentrated electromagnetic field of the detectors enables a very exact pin-pointing; even the course of a located metal wire can be determined.

**Employment:** German Federal Republic (Army, Lufthansa and Police).

**Data:** length 39cm (MH 1603), 40cm (MH 1604), 38cm (MH 1607); weight 0.5kg (MH 1603), 0.45kg (MH 1604), 0.41kg (MH 1607); power 9V battery.

**Metal Detector Model ML 1750:** This jeep mounted mine detector is included because it is particularly suitable for IS operations. It would largely be irrelevant in conventional warfare, where a more blunt instrument such as a flail or dozer tank would be used; however, in an IS situation, the ML 1750 would be ideal to clear tracks of metal-based anti-vehicle mines.

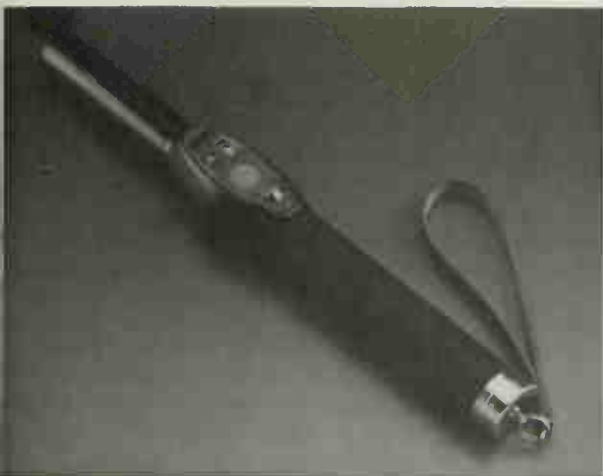
**Data:** width of location 1.60m; weight of detecting coil 43kg; power supply 12V; current consumption 3 amps.

**Metal Detector Model MP 1781:** Developed for use in airports this equipment provides a visual alarm signal when any metal object passes through the gateway.

**Variants:** Model MP 1770 employs the same gate and footbridge but has a slightly more sophisticated electronics cabinet, which indicates the part of the body where a metal object is secreted. Model MP 1783 indicates the type and size of the metal object.

**Employment:** German Federal Republic (Airport Authority, Lufthansa).

**Data:** electronic cabinet weight 14.5kg; gate and footbridge weight 87kg; cabinet depth 28cm; cabinet width 49cm; cabinet height 18cm; gate depth 39cm; gate width 91cm; gate height 2.16m.

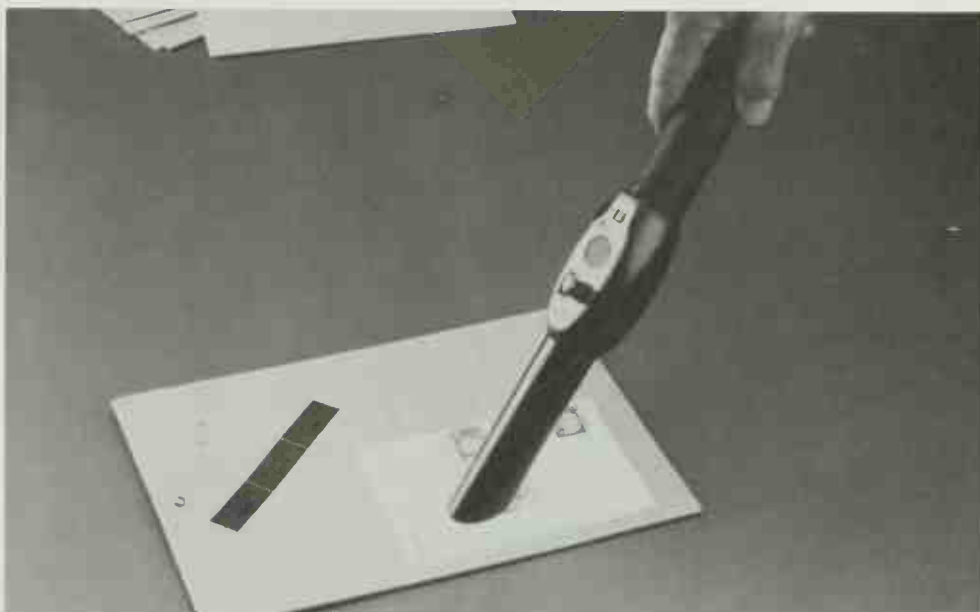


**Top and centre left:** The Ferex 4.021 Search instrument and its alternative attachments. The variety of attachments illustrated shows the especial adaptability of the Ferex for IS work: searching for bomb-making equipment in inaccessible locations such as manholes, sewers and in watertight containers on river beds.

**Bottom left:** The Vallon Electronic Bomb Detector Model MB 1710A. The IRA has mounted spasmodic letter-bomb campaigns against prestige targets in the United Kingdom since the early 1970s. The latest of which, at the time of writing, was in April 1987 against top officials of the British Government. Equipment such as this offer simple and cheap methods of detecting explosive devices in parcels and letters.

**Above and right:** Vallon Models MH 1603, MH 1604 and MH 1607, typical of the many hand-held metal detectors on the market.

**Bottom right:** Vallon ML 1750, the vehicle mounted metal detector. An equipment such as this would be useful against the threat faced by South African security forces.



**Right:** Valon metal detector model MP 1781. Variants 1770 and 1783 provide more precise information.



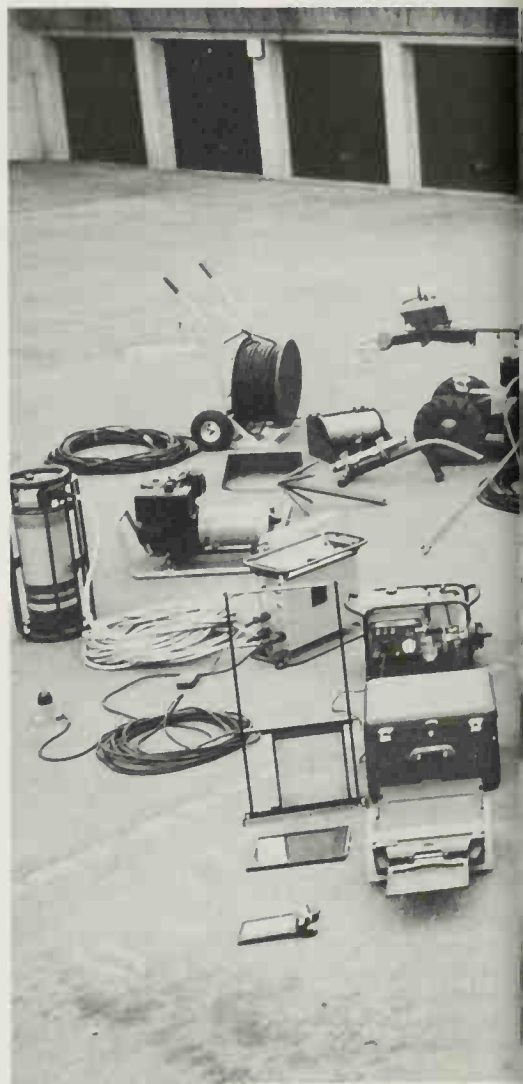
**Right:** The Riwosa Metal Detector MD-12, in wide use by EOD personnel, police and airport authorities for bodysearch and checking small packages.



## SWITZERLAND

### Riwosa Metal Detectors

**Model MD-12:** Developed by Riwosa of Zurich for detecting weapons or other metallic objects, this equipment has sold in large quantities. It operates on three 9V batteries. **Employment:** British MOD, London Metropolitan Police, British Home Office, British Atomic Energy Commission, British Foreign and Commonwealth Office, British Department of the Environment, Iraqi Army, Kenya MOD, and Hong Kong, Indian, Pakistan and Taiwan Governments; also the police forces of Nigeria, Oman, Barbados, Gibraltar, Seychelles, Antigua, and Sharjah, and the security sections of British Airways, Air Canada, Air France, British West Indian





**Below:** Tig Bicord supply a complete EOD system, which comes in a specially equipped van. The display of tools shown here includes the Garant EOD vehicle, a disruptor and various stands on which the disruptor can be fitted, including one to hang the apparatus directly above the suspect object, EOD suits, under-vehicle inspection mirrors, tripod-mounted lights and bomb disposal tool kits.

Airways, China Airlines Ltd, Malaysian Airlines, National Airlines, Qantas Airways, Zambia Airways, Thai International Airline, and Singapore Airlines.

**Data:** weight 1.76kg; length 40cm.

**Model MD-15:** This improved version boasts printed circuitry, full transistorization, lightweight construction and very low power consumption. The size of a detected object can be estimated instantaneously by pitch and volume signals received via louspeaker or headset units. Simple to operate, it detects both ferrous and non-ferrous metals.

### **Tig Bicord EOD Equipment**

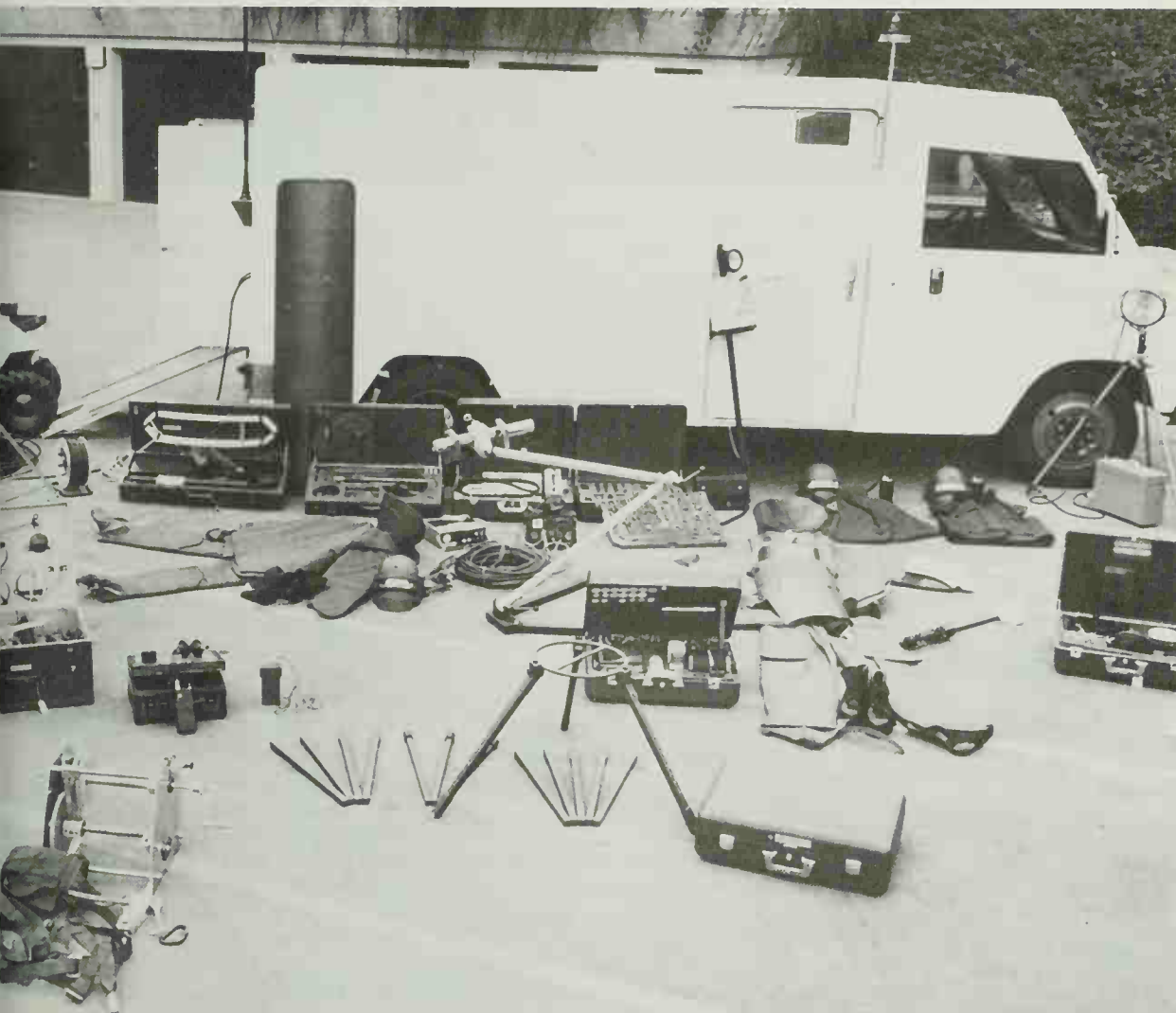
**Anti-Magnetic Tool Set ASW-1:** These tools are made of high-grade, anti-magnetic Beryllium.

**Armoured EOD Van:** A comprehensive

package for civilian or military EOD experts, this carries the complete range of equipment necessary for a bomb, hostage or shoot-out situation including the Garant-1 EOD robot vehicle.

**Employment:** It is in service with various European police forces.

**Data:** The vehicle (Type EOD/KFZ) can be supplied with the following equipment: 1 bomb protection blanket (type BSD-2); 2 bomb protection suits (BPS-1); 1 portable telephone equipment for the bomb protection suits (TTV-1); 1 portable EOD protection shield (PS-15); 2 bullet-proof vests (AN-PO-1); 2 bullet-proof safety helmets (PSH-77); 2 mine detection protective suits (BPS-2-L); 1 mine detecting unit (ML); 1 set of anti-magnetic tools (ASW-1); 1 hook and line set (HLS); 1 defusing unit (EG-2); 1 defuser





**Above:** The Tig Bicord Transport Trailer. This equipment is designed to remove and contain relatively small weights of explosive. Clearly, larger bombs could not be contained within its relatively thin walls. Its main purpose is to vent any explosion upwards.

**Above right:** The Tig Bicord Defuser/Disruptor EG-2, shown here about to shoot out an automobile door lock. Note that the stand on which the disruptor is fitted is adjustable horizontally and vertically.

**Below right:** The Tig Bicord Explotest-100 portable explosives detector.

stand (STD-2); 1 defuser tripod (DRB- 2); 1 fuse removing unit (ZAG-1); 1 portable X-ray equipment (RB-1); 1 portable developing unit (EWG-1); 1 stationary X-ray unit, 300KV (RN-2); 1 stationary developing unit (EWG-2); 1 explosives detecting units (Explotest-100); 1 remote-controlled robot vehicle (Garant-1) with accessories; 2 track planks for the robot; 1 winching-down unit (RE-1); 1 cable winding unit for the above (RE-WM); 1 portable power generator 12/220V (TSE); 1 set of electrical tools (SEW-1); 1 portable floodlight with tripod and 12V battery (TSBD-1); 1 cable drum with 200m cable (KTR-1); 1 inspection mirror (MIR-1); 1 inspection mirror (MJR-2); 1 siren (S-1); 1 blue light with magnetic base (BL-1).

**Bomb Transport Trailer BOA-1:** This enables a bomb to be removed from a location where an explosion would cause damage or casualties to a place where it can be dealt with in safety. Tig Bicord have also developed a technique to freeze an IED, and the trailer will keep the bomb frozen.

**Defuser/Disruptor Model EG-2:** This is used to shoot the caps from tubular bombs, to destroy the detonators of unexploded grenades or bombs using a steel bolt or a water charge. It can also be used to shoot out locks. The Tig Bicord system is contained in three carrying cases, one for the defuser/disruptor and acces-

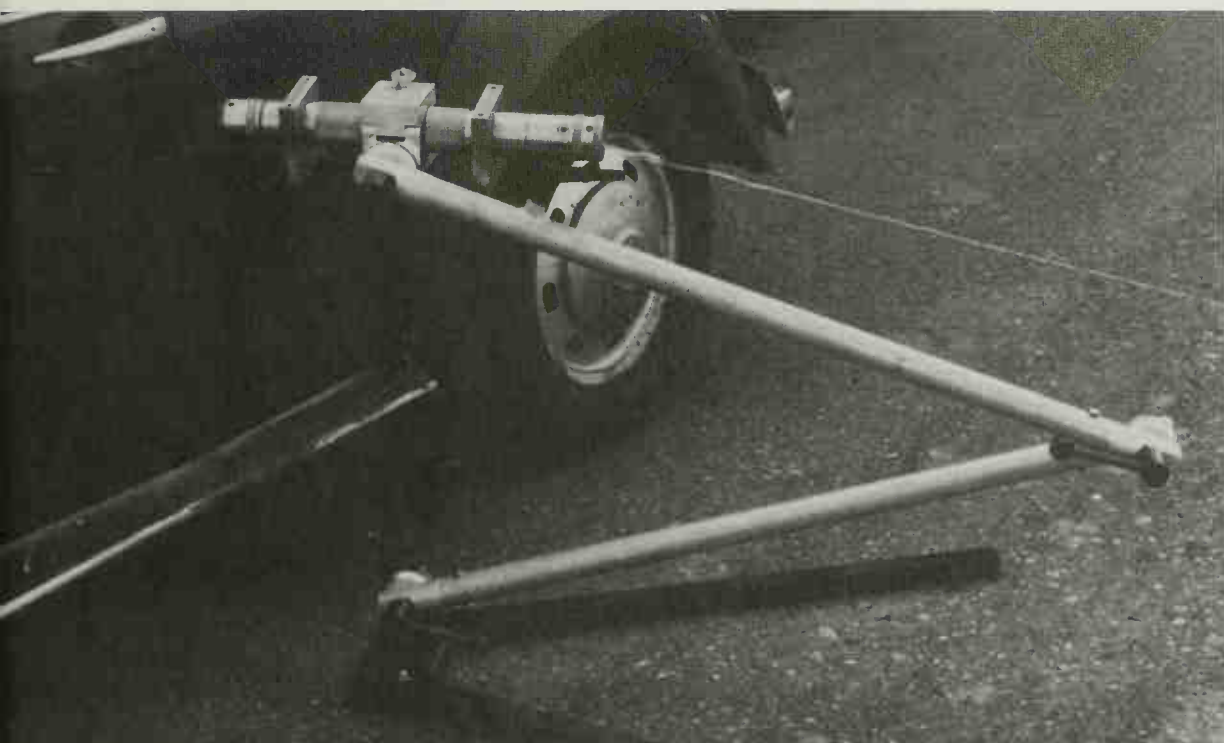
sories, one for a folding stand, and a third for a folding tripod. The defuser/disruptor case also contains a suspension device for vertical shooting, a fixing cable with spring safety hook, a muzzle brake, an optical sighting mechanism, a detonator, a cable reel with 200m fuse cable, 50 propulsive charges, 50 powder ignitors, 20 steel bolts, 100 closing blanks, and 100 cup sleeves.

**Explosives Detector Explotest-100:** This portable explosives detector identifies most explosives and is particularly suitable for inspecting vehicles. The detector has an integrated battery, but can also be connected to a 12V or 24V power supply.

**Garant-1 EOD Robot:** This large, wheeled and very powerful robot EOD vehicle can lift and tow suspect cars. It is also capable of lifting portable X-ray equipment to a target and returning with the exposed film. Accessories include a towing hook, a cable drum, a large shovel with 75kg capacity, a small shovel and a remote control operating unit.

**Employment:** Various European police forces and EOD units.

**Hook and Line Set (HLS):** The EOD expert is often confronted with a problem that can only be solved by moving parts of the bomb from its surroundings; to do this from a safe distance, hooks and line are used, with various accessories.





## UNITED KINGDOM

**A.I. Security EOD Equipment**

**Bomb Disposal Van (BDV):** This mobile workshop and equipment store in its most basic form consists of a large capacity, fast van seating three people in the cab. It is equipped with sirens and blue lights; floodlights are mounted on a telescopic mast extending upwards from the roof. Inside it carries an auxiliary generator, traffic barriers, non-magnetic tools and a complete set of electric tools. It is fitted with a number of cupboards, trays and racks for storing these items. A large number of options can be specified. These include air conditioning, an extra-high roof and additional seating in the back of the van. In addition, a wide ranging selection of bomb disposal equipment can be specified.

**Electronic Stethoscope Model 80:** Designed for military use, this equipment amplifies sound waves emanating from clockwork-type fuses and similar mechanisms in parcels, luggage, etc. A cable reel permits application from a distance.

**Explosives Detector Model 85 Entry Scan II:** A second generation walk-through explosives detector (or 'sniffing doorway'), this is both a metal detector and an explosives 'sniffer'. It has three models: 1. Walkthrough – people are tested sequentially without having to

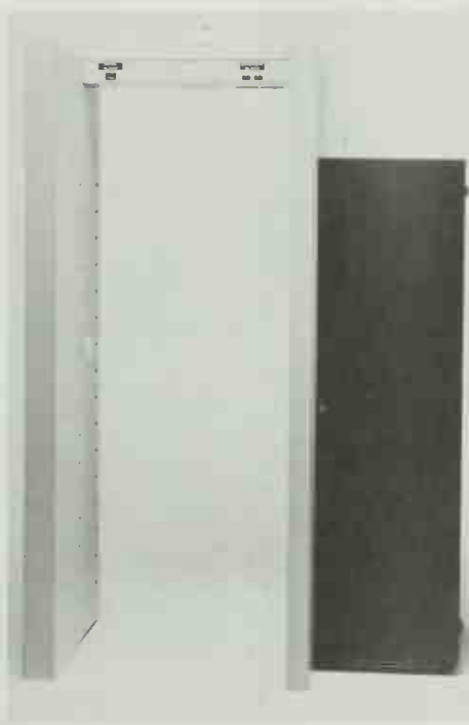


**Left:** Another complete, mobile EOD package, this time from A.I. Security.

**Below left:** The A.I. Security experimental bomb trailer, suitable for accommodating and transporting small explosive devices.

**Above right:** An alternative method of transporting bomb disposal kit to an emergency can be an estate car if the equipment is small enough. Here, Ro-Veh, A.I.'s remotely controlled EOD vehicle (described on pages 67–9) demonstrates how compact it is, fitting into the boot with the control console to the left.

**Below right:** Entry Scan II metal detector.



pause in the arch; the alarm comes *after* six seconds, so it is used ideally in this model when people are detained for at least 6 seconds by a subsequent security (e.g., documents) check. 2. Fast – red/green lights instruct people to remain in arch for six seconds. 3. High sensitivity – test time is ten seconds, with electronic integration of results from a 100-segment trap.

**Employment:** Airports throughout the world.  
**Data:** *overall height 2.15m; floor space required 1.2m × 0.62m; response time 6 seconds from start of test, 10 seconds in high-sensitivity mode; false alarm rate less than 2%; MTBF better than 1,000 hours.*

**Explosives Detector Model 70:** Designed for use by non-technical personnel, this model has been configured to make it completely field-portable. Model 70 incorporates a small sampling pump, which draws in air via the probe on the front of the hand unit. The detection system continually analyzes the sampled air for the presence of explosives vapour and when explosive is detected the instrument will give an alarm. The twin detectors enable Model 70 to characterize the



explosive vapour and to differentiate it from other vapours, which have been known to give false alarms on some types of explosive detectors. The operator is warned of the presence of explosives by an illuminated visual display and an audio signal from a loudspeaker, both of which are mounted on the hand unit. A headset is provided with the equipment which may be used instead of the loudspeaker if the operator is working in a noisy environment, or if the audio signal from the loudspeaker could place the operator at risk. A switch is provided to eliminate the audio alarm completely if required. Model 70 will detect Dynamite, TNT, Gelignite and a wide range of military plastic explosives.

**Employment:** Used by police, military, customs and postal services in more than 40 countries.

**Data:** weight 14kg; depth 24.1cm; width 15.4cm; height 54.9cm; response time 1 second.

**Explosives Detector Model 55:** Developed as a cheaper alternative to Model 70, this is specifically designed for use by police and military personnel. The extreme portability and fast warm-up of Model 55 make it the ideal unit for use in a 'grab and go' situation. The instrument can be in operation two minutes after an alert is received and can operate for several hours before the battery needs recharging. The battery is plug-in and can be changed for a fully-charged one in the field if additional operating time is required. Its applications include screening suspect packages and vehicles, searching buildings or aircraft, checking baggage at airports, checking suspect persons for explosives or explosives residues, protection of military or nuclear installations, and protection of vital personnel and key targets.

**Data:** weight 8.5kg; depth 15.5cm; width 13.2cm; height 31cm; response time 1 second.

**Explosives Detector/Identifier Model 62.00:** This consists of a portable unit mounted on a wheeled trolley and a hand-held search gun. It can be operated for over four hours from built-in batteries or direct from the a.c. supply. It has two modes of operation – the 'search' mode and the 'identify' mode. In the 'search' mode it continuously 'sniffs' for explosives with a two-second response time, and an alarm is given audibly from the probe or visually from the meter. If a response is obtained, the unit is 'sniffed' again for a period depending upon the sensitivity required and the resulting vapour collected is then chromatographed. From the results it



**Left:** A.I. Security Model 70 Portable Explosives Detector, showing the sniffer probe (top) and in use (below).

**Above right:** Model 55 Explosives Detector, a smaller, lighter, more easily portable version of Model 70.

**Below:** Model 35.

**Below right:** Model 62.000 in operation.

possible to identify the explosive and non-explosive materials. (When sifting the remains from explosions, it is desirable to obtain as rapidly as possible information on the type of explosive used.) The equipment can be used for checking parcels or suitcases, searching aeroplanes or houses and road block checks. In some cases, an overall check in the 'accumulate' mode of a house, for example, can give an indication that explosives are or have been used; the 'search' mode is used second in this case to locate them exactly.

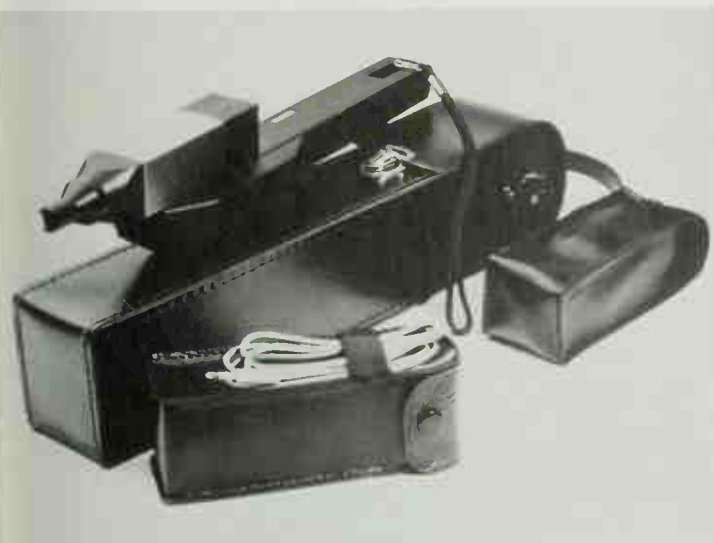
**Employment:** In use in more than forty countries.

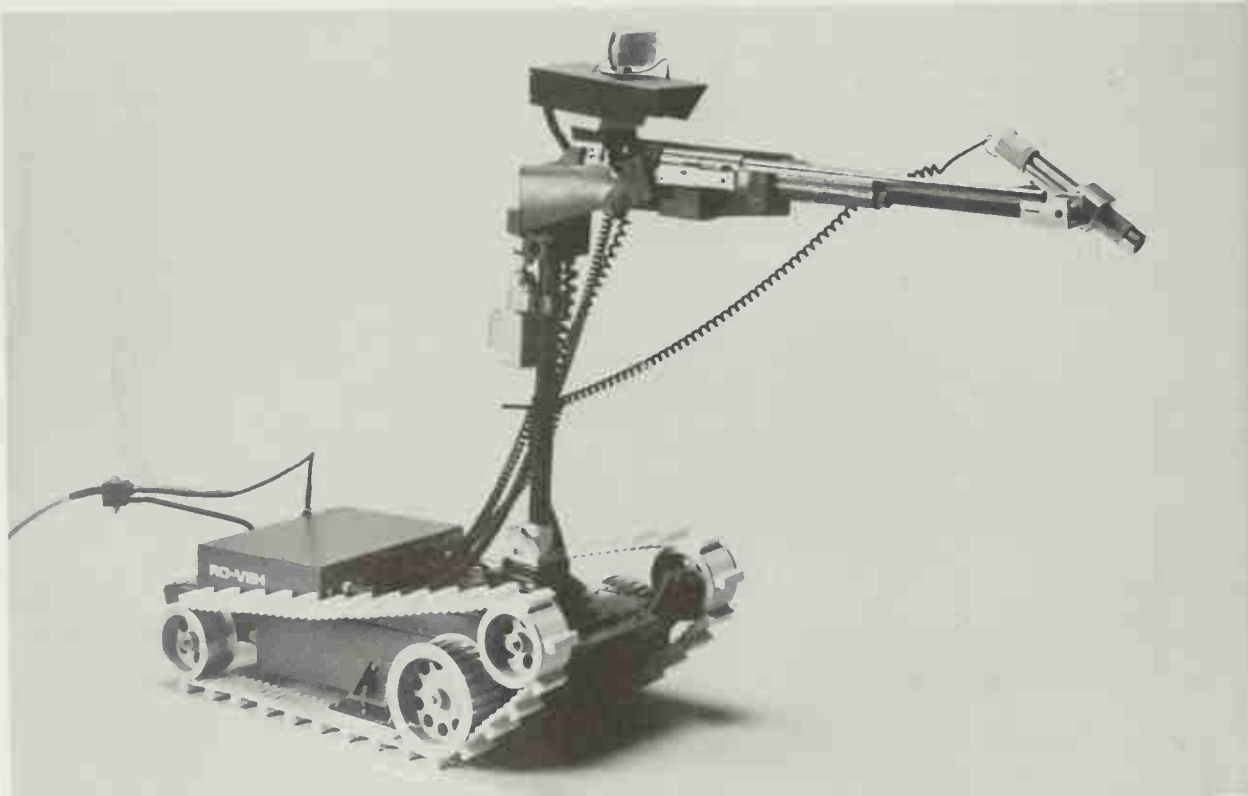
**Data:** weight 30kg; depth 27cm; width 37cm; height 80cm; response time 2 seconds (search mode), 1 test every 3 minutes (identifying mode).

**Lightweight Explosives Detector Model 35:** A pocket-sized equipment that only requires small radio batteries for operation. Model 35 requires no gas or a radioactive source, which some explosives detectors need. The equipment will detect very small quantities of explosives and will not give false alarms to dry-cleaning fluids and similar chemicals. The rechargeable battery gives up to one hour's use; alternatively, the operator can use any 12V external supply.

**Data:** weight 400g (hand-held operational), 2.965g (with battery charger and rechargeable battery); length of detector 340mm (with short probe); dimensions of whole equipment in case 380mm × 220mm × 100mm; response time less than 1 second.

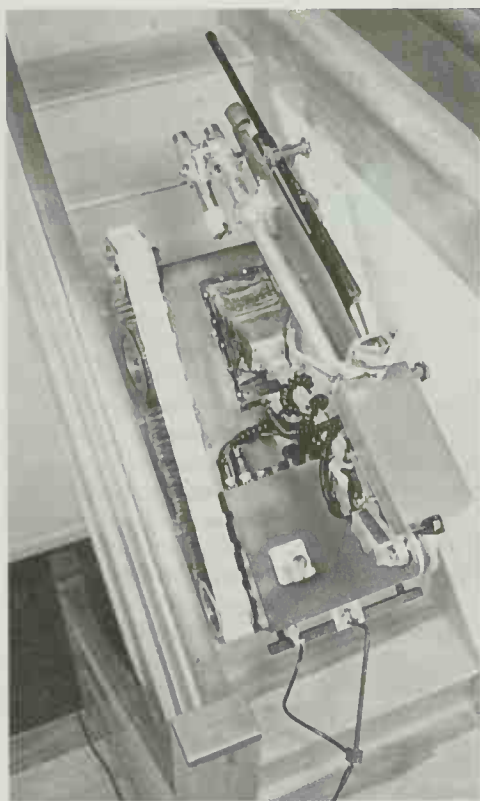
**Remotely Controlled Vehicle Ro-veh:** The entire system works from either mains electricity or a portable generator and the power







A.I. Security Remotely Controlled Vehicle Ro-Veh in its wheeled configuration (top left), wearing tracks and mounting a shotgun and disruptor (below left) and using a boom extension with disruptor to deal with a suspect package under an automobile (above). Right, demonstrating its stair-climbing capability.



is transmitted down the cable at only 65V. All the video analog and operating signals are multiplexed down a single co-axial line. The combination of relatively high but safe power voltage and multiplexing on the co-axial line results in a very thin flexible cable (which is steel reinforced). Since there are no batteries at all, the vehicle is light and easy to man-handle; severing of the cable leaves Ro-veh inert and totally safe. Momentary short circuits during the cutting of the cable cannot fire the armaments, since that depends on receipt of digitally coded signals from the control module. The lightness of Ro-veh and the special attention paid to tread design results in a vehicle with exceptional stair climbing ability. When Ro-veh is used on flat ground, the wheels can be lifted in a few minutes giving a smoother ride and higher speed. The control console houses a video screen and all other controls: camera, armament (shotgun, disruptors, charge dropper, etc.), drive and boom controls. The armament is mounted on the superstructure. The standard boom arrangement folds away entirely within the length of the vehicle, but the modular construction using quick-fit connections allows any lengths or angles of boom to be constructed.





quickly on any suspect item or non-readily identifiable item both improves the effectiveness of the search and speeds it up. More than one person may view the screen simultaneously, enabling the accumulated experience of several security guards to be utilized. When the lead shield closes over the suitcase, a pump reduces the pressure of the baggage chamber by 1/10 atmosphere. The extracted air is fed directly to an explosives detector. If an explosive vapour is indicated the alarm is only seen by the Tri-Scan operator who can request a search of the suspect bag.

**Employment:** Various international airports.  
**Data:** *maximum baggage dimensions* 76cm × 61cm × 36cm; *operational frequency* 5 bags per minute; *response speed* 3-4 seconds.

**Metal Detecting Doorway Model 857:** This archway provides indication of the types of metal it detects, including coins.

**Explosives Detector Model 97:** This, the latest from AI, is a fourth generation lightweight device containing a real-time vapour detection system, based on gas chromatography, that will pick up one part of explosive vapour in 10 parts of air.

**Data:** *carrying case dimensions* 50cm × 37cm × 16cm; *hand unit weight* 13.5kg.

## Adams Electronics Detection Equipment

Adams Electronics of Crawley, Sussex, produce a wide range of detection equipment including metal detection archways, hand search probes, ground search detectors, letter bomb detectors and weapons location systems. Of the fourteen detection systems currently manufactured by Adams Electronics, the following three equipments have been selected as representative.

### Advanced Weapons Location System AMD 690:

This body scanning system provides visual and audible indication of where metal is being carried. Three bar graphs and two audio tones are used: the centre bar graph (red) indicates the level at which the alarm threshold is set; the top one (yellow) indicates the level of metal present in the top half of the archway and compares it with the alarm threshold; the lower (green) one indicates the level of metal present in the bottom half of the archway and compares this with the alarm threshold. If the yellow bar graph exceeds the alarm level, audio warning 'A' sounds; if the green bar graph exceeds the alarm level, audio warning 'B' sounds. If both halves exceed their alarm level, both audio warnings sound simultaneously, indicating metal carried at the middle of the body.



**Top:** A.I. Security's Tri-Scan Airport Security System, an example of a standard luggage X-Ray and explosives vapour detection system.

**Above:** The Adams AMD 690 body scanning system, a very simple to operate weapon location system.

**Employment:** Various security agencies.

**Data:** *length* 1.12m; *width* 0.62m; *height* 0.37m (on tracks, without superstructure), 0.46m (on tracks, with superstructure folded); *reach* 2.06m (on tracks, with superstructure extended), 2.15m (on wheels, with superstructure extended); *arm movement* 180° (upper), 110° (lower); *turning radius* 0.65m (using neutral turn); *drive motors* two 95W (2 × 1/4hp); *speed* 26cm/second (tracks), 44cm/second (wheels).

**Tri-Scan Airport Security System:** An X-ray and explosive vapour detector are here combined. The component parts of a bomb may not be all in one bag but may be present separately in several bags for subsequent assembly by the terrorist. Use of an overall X-ray of the bag plus the ability to zoom-in

**Right:** Adams Electronics IPD/4 lightweight metal detector.



**Data:** height 2.17m; width 0.92m; depth 0.46m; aperture height 1.98m; aperture width 0.76m; power consumption 30VA; internal battery 12V DC 3amp/hour automatically recharged; ambient operating temperature range  $-10^{\circ}\text{C}$  to  $55^{\circ}\text{C}$ ; relative humidity 10–95% non condensing.

**Intimate Personal Detector IPD/4:** This equipment has been designed to meet the need for a very lightweight metal detector capable of being used for long periods without reducing operator concentration through fatigue. The detector has good sensitivity, a high standard in toughness and reliability and is simple to operate. It has been specially designed to detect concealed metallic objects, including firearms, knives, ammunition and explosive devices. The equipment can be used to carry

out personal searching of passengers, staff or other persons to detect possible hidden metal objects without physical contact by the searcher. It is also suitable for screening mail for explosive devices, and it can be conveniently used to detect metal items located under the surface of walls, floors or other non-metallic materials.

**Employment:** In service worldwide.

**Data:** length 38cm; weight 340g; battery standard 9V (gives 2–3 months operation); operating temperature  $-25^{\circ}\text{C}$  to  $60^{\circ}\text{C}$ .

**Mail Check Probe LB/2:** This detector will locate large and small (ferrous and non-ferrous) metallic objects concealed in letters, packages or parcels. When set up in its operating mode (which takes a few seconds) the gradient of the chute ensures clearance by

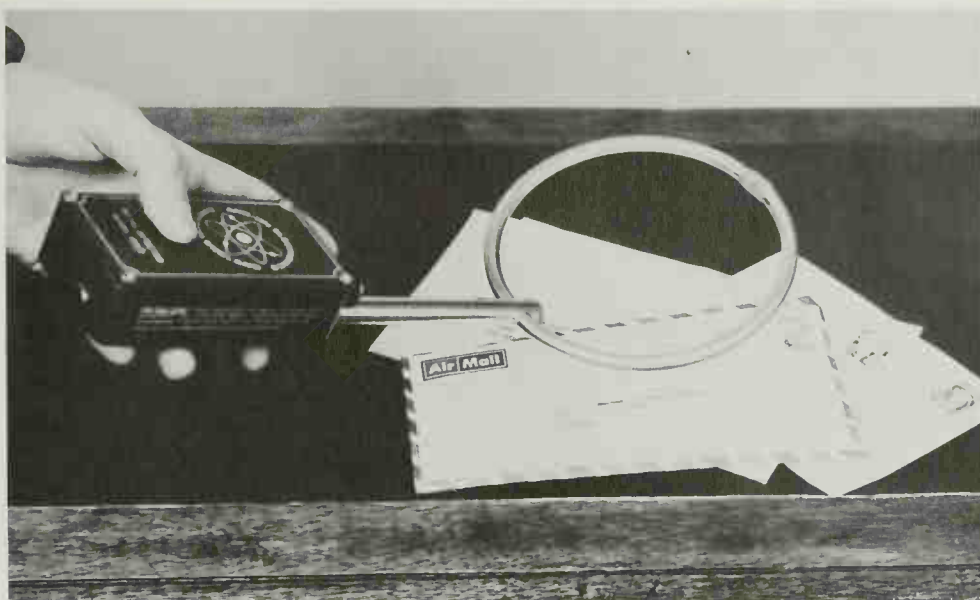




**Top left:** Adams Electronics letter bomb detector, which is based on a simple slide principle.

**Right:** The Add-On Electronics IPD-25 metal detector.

**Below left:** Add-On Electronics B-100 and IPD-2L metal detectors in use.



gravity of even the lightest letters, while maintaining screening sensitivity. After use the Mail Check Probe can be folded flat to a depth of 5.5cm for easy storage. The LB/2 requires only a very small temporary working area (corner of a wooden desk/table, for example) and can be conveniently put away when not required. It is particularly suited for travelling VIPs, owing to its compactness and light-weight; it can be carried in a brief case.

### **Add-On Electronics Metal Detectors**

**B-100:** Add-on Electronics of Edenbridge developed this high sensitivity metal detector for the detection of all ferrous and non-ferrous metals. It was designed for airport security and police work, although there are numerous uses in the commercial field.

**Employment:** Germany (Police), Thailand, United Kingdom (Army).

**Data:** diameter 21.6cm; height 10.2cm; weight 0.59kg.

**IPD/2S:** Complementary to the B-100 hand detector, the IPD/2S is suitable for searching personnel, baggage, walls, floors, etc. for metal objects such as arms and ammunition. The IPD/2S is also widely used for screening mail for explosive devices, and is capable of detecting very small metal parts, including those made of stainless and austenitic steel.

**Variant:** The IPD/2L has a longer stem (51cm) and the weight is increased to 539g. The longer stem enables the front and back to be searched without either the person being searched or the operator having to turn or move around.

**Employment:** The IPD/2S is in use in no less than 107 countries. These include Spain, Morocco, Germany, Finland, the Republic of China, Thailand, Holland, Norway, South Africa, Nigeria, India, Japan and Hong Kong.  
**Data:** weight 454g; length 36cm; battery life 2-3 months.

### **P. W. Allen EOD Equipment**

**EOD Inspection Set:** Developed by P. W. Allen of London, this set is designed to assist EOD operatives in the internal inspection of IEDs of all kinds including parcels, packages, cases, luggage and also inside locks, particularly where forensic evidence is required. Components are made of non-ferrous metals and include various light probes, extension rods, round mirrors, a recovery magnet and hook, lock viewers and illuminated inspection mirrors.

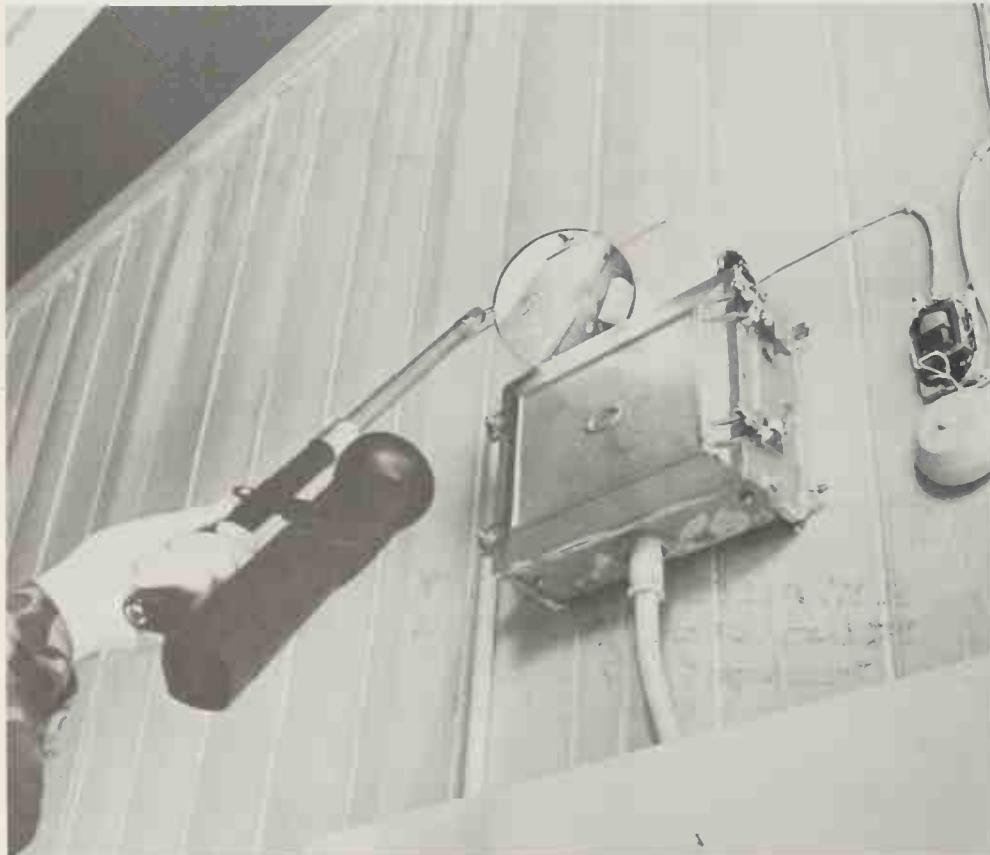
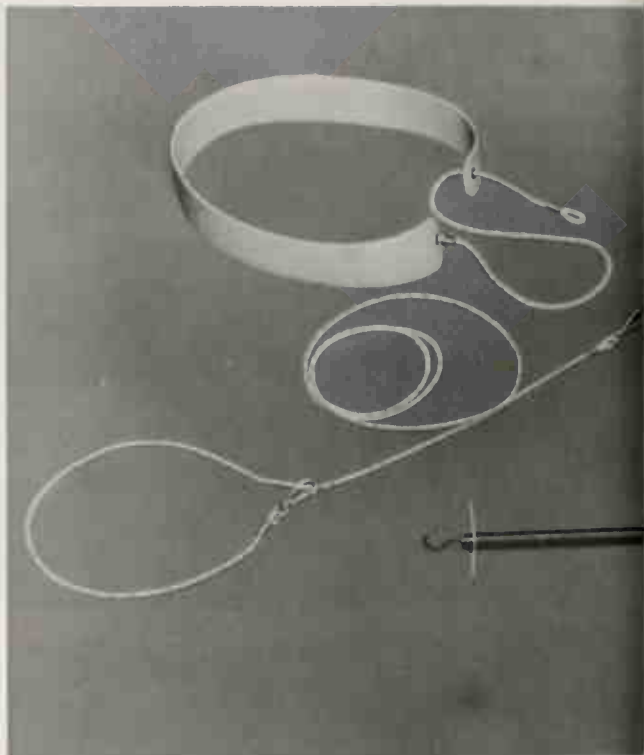
**Employment:** Worldwide.

**Data:** case dimensions 61cm × 48cm × 7cm; total weight 5kg.

**Fluorescent Hand Lamp Model A33:** This produces a flood of white light over a large area and is particularly suitable for mobile search teams operating at night. The lamp uses a 22.9cm fluorescent tube powered by a 12V dry battery. One battery will give over eight hours continuous operation, and well over 30 hours with normal intermittent use. The light provided by the lamps is comparable to that from a 40-watt tungsten lamp.

**Employment:** United Kingdom.

**Hook and Line Set Type HAL:** Each set consists of a reel holding 100m of line mounted on



P. W. Allen EOD Equipment.

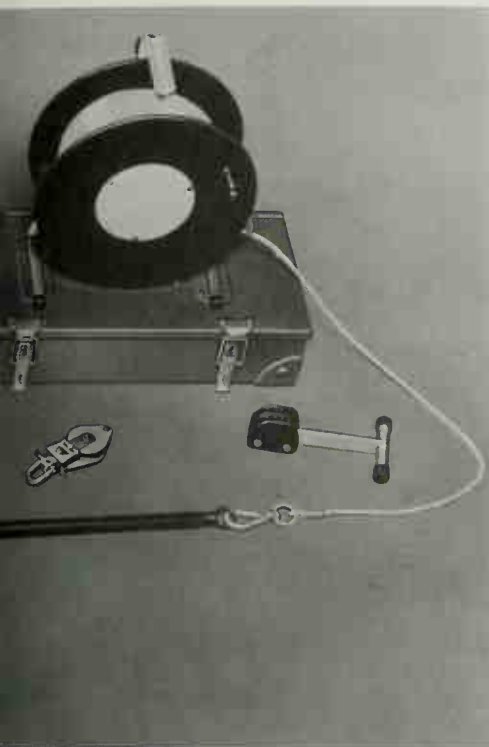
**Top left:** The EOD Inspection Set.

**Above:** The Hook and Line Set.

**Above right:** Inspection of the interior of a standard British Army Type 36 grenade with the aid of an Allen safety light probe.

**Below left:** The use of the Telescopic Illuminated Search Mirror.

**Below right:** The Allen Search Endoscope Set SE30 Mk 2.







a strong steel case, which contains a selection of lines, hooks, strops, extension rods, pulling handles and snatch blocks. This set has been developed to assist trained EOR/EOD operatives in moving and/or lifting IEDs or other potentially hazardous objects. The equipment is compact so that it may easily be carried in service vehicles. A carrying handle enables it to be transported by one man.

**Data:** case dimensions 51cm × 25.5cm × 11.5cm; weight 19kg.

**Inspection Mirror Type CEM/ILL:** An illuminated, telescopic inspection mirror, extending from 510mm to 1550mm in six sections. The stem is grooved to prevent rotation during extension, and five optional mirror attachments are available. The mirror is mounted on a fully flexible ball-and-socket joint.

**Safety Light Probe:** A hand held battery-operated light source with a 15.2cm long × 3mm diameter fibre optic light probe. The lamp is totally enclosed in the handle, and the light, which is 'piped' into the object being inspected by the fibre optic probe, is therefore cold (and safe).

**Employment:** United Kingdom (Army) and many other operators throughout the world.

**Search Endoscope SE30 Mk 2:** The SE30 Endoscope (or Periscope) is designed to assist arms/contraband search teams in searching normally inaccessible places. It is made up in seven sections: one ocular (or eyepiece) tube, two objective tubes (one for direct forward viewing and one for lateral viewing) and four extension tubes. Tungsten/halogen lamps are housed in the objective tubes. The equipment is able to focus from a few centimetres to infinity with great depth at any setting. The SE30 is particularly suitable for searching buildings, vehicles or ships without breaking walls, ceilings or floorboards or offloading vehicles or removing panels or container sides from ships.

**Variants:** The Allen Search Endoscope SE737 is an unilluminated hand-held endoscope designed for use by infantry patrols searching buildings. With a 65° angle of view and alternative direct forward or 90° viewing, it enables an operator to see the whole of a room through a hole only 20mm in diameter; this includes all the back of the door or wall through which the equipment is placed. No focusing is required.

**Employment:** These equipments are in use with the British Army and in many other countries throughout the world.

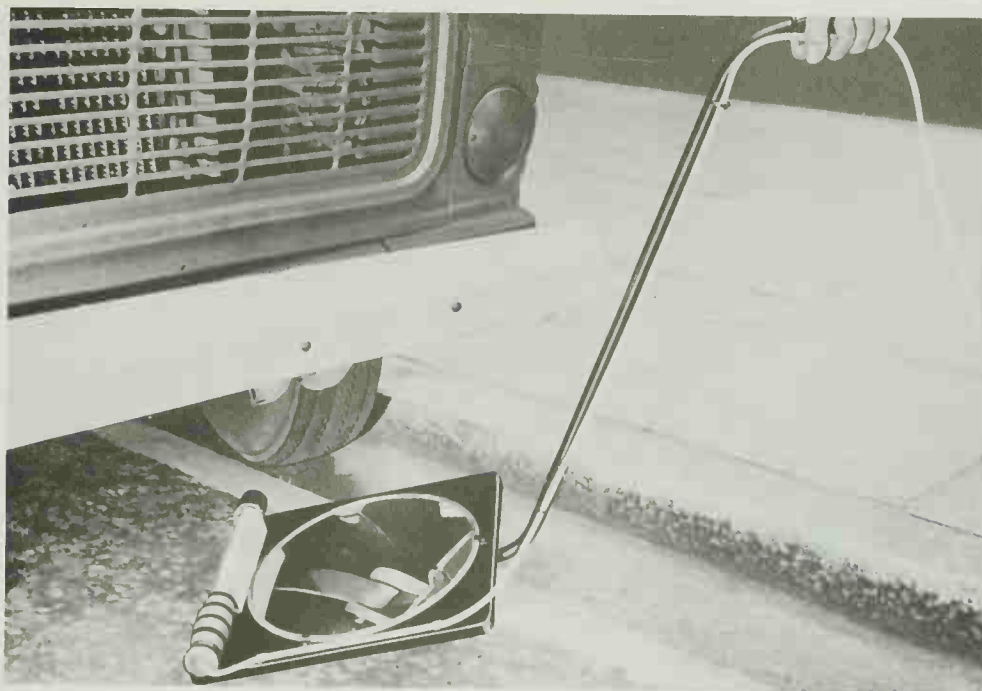
**Data:** length 3.08m (also useable in lengths of 0.68m, 1.28m, 1.88m and 2.48m); diameter 3cm; weight 12kg.

**Top left:** The Allen SKM Search Set. Allen are the leading British manufacturer of EOD hand instruments.

**Below left:** The Allen SKT Search kit.

**Right:** The Allen VM Under-Vehicle Inspection Mirror.

**Below:** The Allen VSM Under-Vehicle inspection Mirror. These types of light/mirror combinations are in wide use at government and military installations, affording a quick and simple means of checking vehicles at entry points.



**Search Kits SKM and SKT:** The SKM is a highly comprehensive search kit with the appearance of conventional hand luggage allowing discreet and unobtrusive handling. It includes the Allen Endoscope, with its attendant range of light probes, together with telescopic mirrors to allow searches in containers, ducts, cavities, engine compartments, etc. The SKT kit contains equipment for searching buildings, vehicles and aircraft.

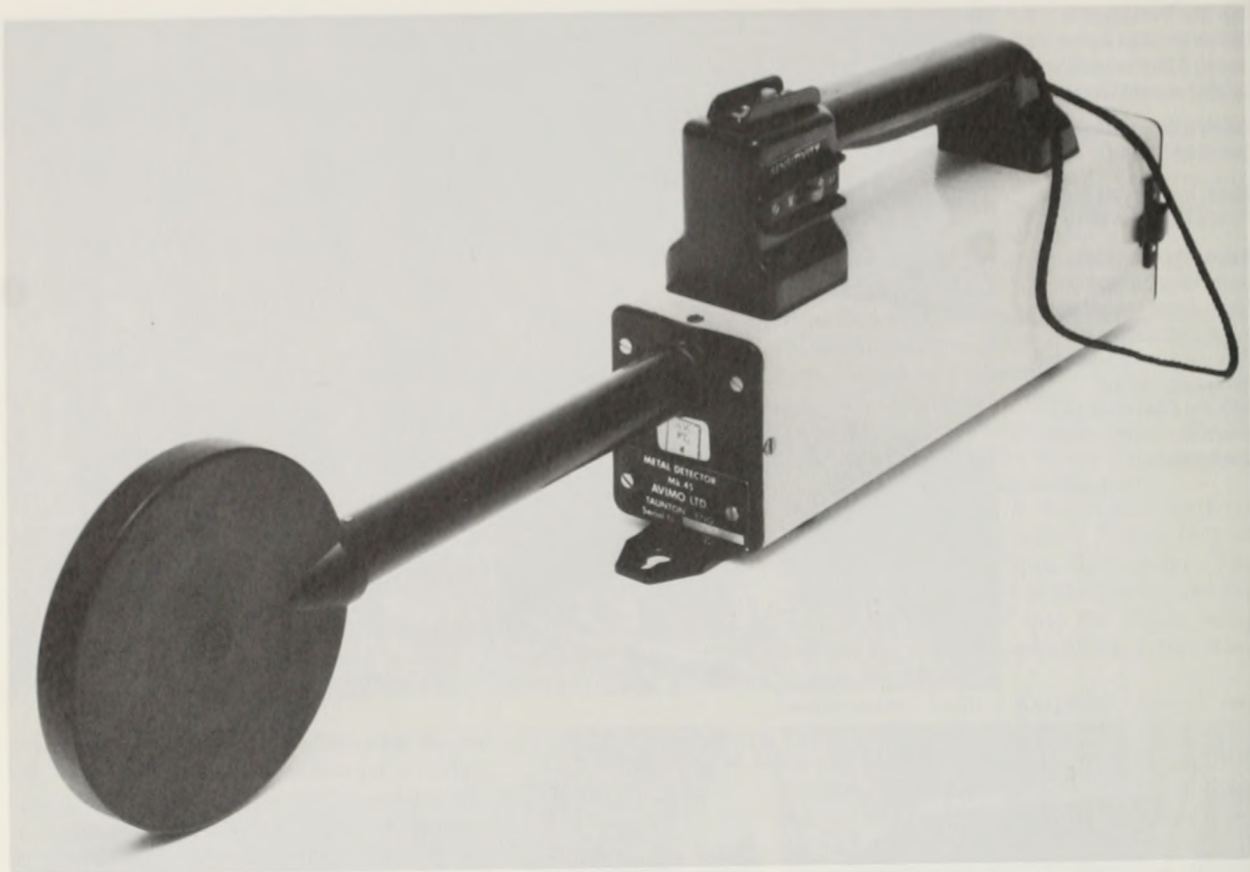
**Under-Vehicle Inspection Mirror Type VM:** Inspection of the undersides of motor vehicles, for security or servicing, is one of the many applications for this mirror. It comprises a thick 30.4cm convex mirror and 22.8cm fluorescent tube mounted on a base fitted with a detachable handle. A ball-caster provides easy manoeuvrability. Power source for outside use is a 12V dry battery.

**Employment:** United Kingdom (widely used, particularly by company security guards).

**Under-Vehicle Inspection Mirror Type VSM:** A hand-held mirror for increased manoeuvrability and versatility, with a usable length of 1m and a powerful lamp to give bright illumination.

### **Avimo Frisker Metal Detector**

The Frisker Metal Detector is a hand-held, battery-operated instrument constructed from high-impact polystyrene. Designed especially to meet the needs of security forces, Frisker's robust but lightweight construction allows



**Above:** The Avimo Frisker Metal Detector.

**Right:** The Bonaventure Electronic Stethoscope, used to listen for noise made by timing mechanisms, thus allowing EOD operatives to identify types of explosive devices.





searching over long periods without operator fatigue.

**Employment:** United Kingdom (various civilian/security organizations) plus several other countries.

**Data:** weight 1.25kg; length 49cm; width 5.5cm; height 13cm; battery life 10 hours (continuous use).

### **Bonaventure International Security EOD Equipment**

**Camera System BIS 65 CCTV:** This low-light television camera has been developed specifically for coupling to a wide range of flexible and rigid optical probes. The camera is coupled to a monitor screen, and the picture can be recorded by a videotape recorder. The device has an obvious application in the EOD field, and can be used to inspect the interiors of packages or confined spaces.

**Data:** dimensions 6.35cm × 29cm (camera), 35cm × 16.5cm × 14cm (control unit); control cable 15mm or 7mm diameter; resolution 400 lines; sensitivity  $10^{-4}$  lux.

**Electronic Stethoscope:** This consists of a pneumatic cavity microphone and a miniature low-noise, high-gain amplifier. A variety of headrests or earshells may be used. It has been used successfully as a bomb disposal aid and more recently in siege situations where the only means of surveillance has been

through the wall of the area in which hostages have been held. It is very compact, and is powered by its own inbuilt batteries.

**Postgard:** When incoming post is placed on the unit, immediate warning of any package that contains the type of component normally found in the detonator of an explosive device is given. Suspect items should then be isolated, prior to investigation by experts. Postgard employs pulse induction technology, a principle used in advanced mine detectors. It is extremely sensitive and immune to normal temperature fluctuations but does not require a skilled operator. It is normally capable of detecting a piece of steel wire 5mm long × 0.3mm diameter contained within a letter.

**Employment:** United Kingdom and USA (widely used by companies in both countries).

**Data:** dimensions 48cm × 27cm × 16cm.

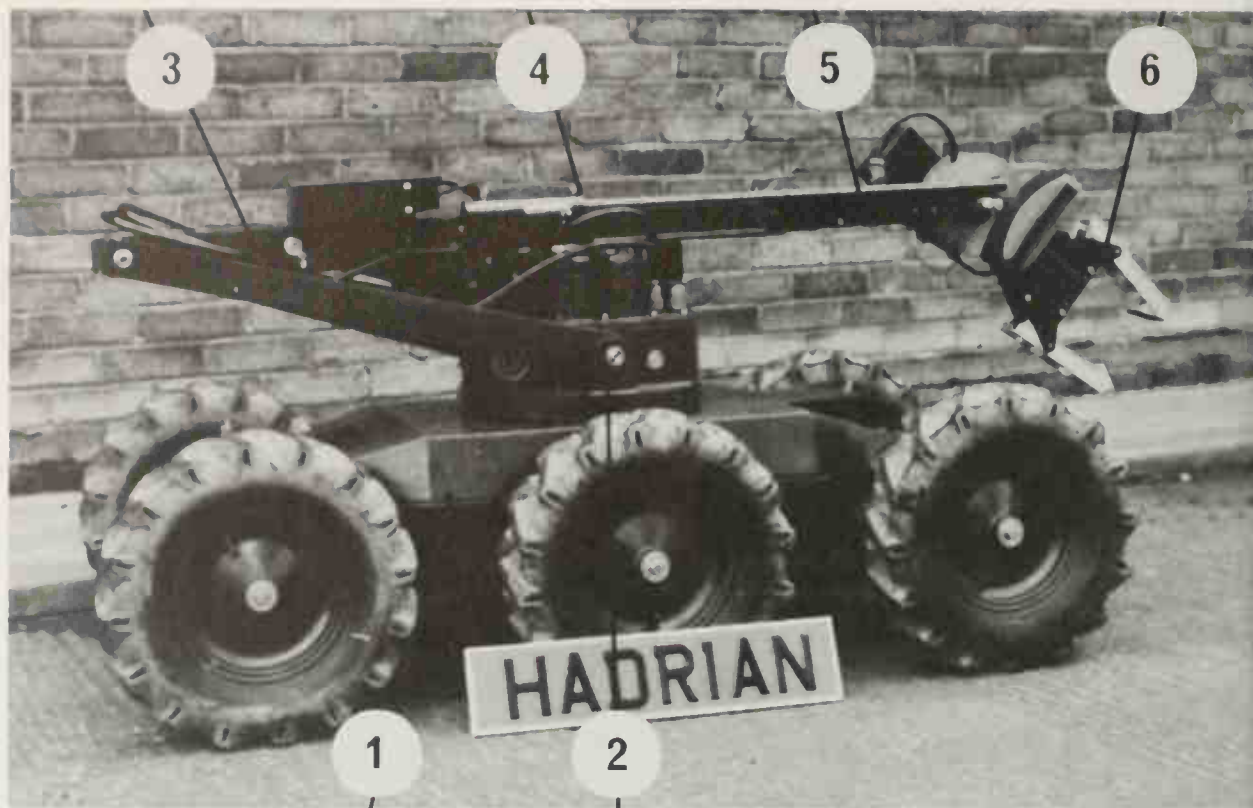
### **Davin Optical IR-Spect Inspection Equipment**

Originally developed by the British Police Scientific Development Branch of the Home Office and now manufactured by Davin Optical, the IR-Spect evolved from a standard IR luminescence technique used in most forensic laboratories for document examination. In the standard forensic technique a suspect document is illuminated with blue light, which excites weak IR fluorescence. The

**Right:** Bonaventure's neat and simple to operate Postgard letter bomb detector.







**Above:** Hadrian Remotely Controlled Vehicle. Keyed components are (1) chassis, (2) turret, (3) leg, (4) shotgun, (5) weapon arm and (6) claw.

small differences in chemical composition of inks that arise when additions and erasures are made to writing can create large differences in the intensity of the IR fluorescence. These differences are revealed by photography using long exposures (up to 30 minutes) with IR-sensitive film. IR-Spect can also give a real-time visible image of the IR luminescence; this means that suspect documents can be inspected very quickly, without the use of photography. The IS application of this equipment to check ID cards is obvious. **Employment:** United Kingdom (various police forces).

### Defence Systems Ltd Hadrian

The complete system consists of a remotely controlled vehicle with a range of operating accessories, a command console with umbilical cable, and a power generator. The vehicle's performance comes from a special six-wheel design, which provides easy manoeuvrability over difficult terrain, long grass and obstacles. Each wheel has independent motor-gearbox drive for maximum traction and mobility and, unlike many tracked systems, the vehicle will continue to operate in the event of individual wheel or motor damage. Both front and rear axles swivel, and

the vehicle can climb obstacles exceeding its own wheel height. Differential-wheel speed control on opposite sides allows the vehicle to turn on its own axis. Speed can be controlled from almost imperceptibly slow to 4kph.

**Remote operation:** Fitted to the vehicle chassis is a remotely operated arm containing a wrist and claw manipulator. At the end of the arm and wrist is a cleverly designed claw capable of continuous rotation, allowing left and right hand screwing operations to be undertaken. It has a grip capacity up to 24cm. The claw has the unique capability of being able to pick up and fire a number of purpose-designed disrupters, selecting and connecting them to the firing circuit without any requirement to return to the operator. Three closed circuit television cameras mounted beside the wrist, gun and front axle allow the operator to view and manipulate objects from any direction in complete safety.

**Accessories:** The operating arm is arranged so that a 12-bore semi-automatic shotgun with rangefinder and sights (and floodlights) can be fitted permanently. Terminals are provided for a wide range of purpose-built accessories, including those for radioactive and chemical handling, fire-fighting, airport security activities, remote surveillance and defence opera-

**Right:** The EMI Pantax X-Checker 30 airport baggage screening system, another example of a standard X-Ray equipment, showing luggage belt for loading and TV monitor screen for inspection.



tions. In addition to the arm accessories there are terminals and littings on the front axle for a large variety of special tools and equipment. These include a large shovel capable of picking up and lifting larger objects. The operator has a clear view of both front-mounted accessories and of where the vehicle is travelling via a CCTV camera mounted between the front wheels. Provision is also made for the mounting of a headlamp on the front axles. Power for all the accessories comes from the vehicle's own power supply. At the rear of the vehicle are attachment points for the fixing of a carrying hod. A specially designed umbilical cable control arm is also fitted to the rear axle. This pivots to keep the cable clear of the wheels and accessories during vehicle manoeuvring. (The claw can be used to pick up and untangle the cable if necessary.)

**Employment:** Negotiations are in hand with several customers.

**Data:** weight 180kg; drive 6 DC motors (all wheels); auxiliary motions 6 DC motors; claw lift capacity 10kg; arm extension 2.4m; arm swivel 360°; lift scoop capacity 75kg; television cameras 3 on board, plus 1 remote; umbilical control cable 225m; power continuous charging sealed batteries; gun 12-bore semi-auto-

matic shotgun; *disruptors* self-installed by robot.

### EMI Baggage Checking Equipment

**Pantax X-Checker 30:** A combined check-in desk, weigh unit and X-ray security screening point. The system has been designed to replace the airline's normal check-in desk. It offers the advantages of electronic weighing with digital readout, plus simultaneous baggage X-ray examination facilities. Associated with the X-30 is a short conveyor belt. The counter clerk, after ticketing the baggage, can feed the airport main conveyor at the touch of a button. With the X-30 system it is possible for one security man equipped with a single TV monitor to control several X-30 units.

**Employment:** British MOD, British Airways, Cathay Pacific Airways, Sultan of Oman's Royal Flight Complex; Directors of Civil Aviation Kuwait, Bahrain, Algiers, Kenya, Philippines, Trinidad, Ras-al-Khaimah; Director of Customs Singapore and US, Zambia, People's Republic of China.

**Data:** weight 750kg; length 2.32m; width 1.07m; height 1.03m; maximum baggage size 91cm × 61cm × 35cm.

**Pantak X-Checker 50:** This system is the base model for the variants described below.



**Variants:** The Pantak X-Checker II X-ray Inspection System, for baggage and freight, is an alternative X-ray system also developed by EMI. It incorporates a conveyor belt to facilitate rapid loading. The maximum baggage size handled is 84cm x 53.6cm x 38cm. The Pantak X-Checker 20 is designed to X-ray hand baggage maximum size 81cm x 61cm x 30cm. Pantak X-Checker systems can also be built into caravans for on site operation.

**Employment:** As for Pantak X-Checker 30.  
**Data:** length 92cm; width 102cm; height 109cm; maximum compartment size 73cm x 76cm x 33cm; maximum baggage size for complete coverage 60cm x 50cm x 33cm.

### Graseby Dynamics Explosives Detectors

**PD2:** Designed to meet the needs of industry and commerce, the PD2 explosives detector is based on the PD1 military version supplied to the British Army. It has a faster response time than the PD1 (only 3.5sec), but still retains the same degree of selectivity. The PD2 is sensitive to explosive substances containing nitrated organic molecules. Its sensitivity to a particular explosive is governed to a great extent by the availability of vapour from that explosive. Nitroglycerine-based explosives, particularly those containing Ethylene Glycol Di-Nitrate (EGDN) give relatively high concentrations of detectable vapour and the PD2 is accordingly highly sensitive to these explosives. Other explosives, such as TNT, DNT, RDX, PETN, etc., have much lower vapour pressures. This means in practice that the PD2 will respond to TNT, but to an extent that varies with temperature. It will not respond to analytically pure RDX, for example, because virtually no vapour is present.

**Employment:** British, Swiss, Italian, Bahrain, Maltese, Danish and Kenya Police Forces; UK Home Office and MOD, Government of Saudi Arabia, Sultanate of Muscat and Oman, and Governments of Libya, Brunei, Romania, and the Philippines; 13 airlines, the BBC and Netherlands Broadcasting Corporation and some seven private companies.

**Data:** weight 10kg; carrying case dimensions 13cm x 45cm x 32cm; dimensions of sensor unit 26cm long x 4.5cm high x 1.2cm diameter; continuous operating limit 6 hours.

**PD4C:** A logical development of PD2, this is a lighter and simpler equipment suitable for use by civilian organizations, the number of controls being reduced to one – a weatherproof on/off switch. The unit automatically adjusts to the surrounding environment, alleviating





**Top left:** EMI's Pantax X-Checker 50.

**Below left:** Graseby Dynamics detectors. From left to right, they are: PD2 Explosives Detector, PD4M Explosives Detector, PD4C Explosives Detector and, in the foreground, GM2 Metal Detector.

**Right:** The HED Explosives Detector Type L3A1 in operation checking for explosives hidden in the panelling of a vehicle.



possible operator error. Warm-up time is only about ten seconds, and when the equipment is switched on a continuous sample of air is drawn in via the nozzle. A concentration of explosive vapour in the sampled air exceeding 1 part in  $10^9$  by volume will cause the instrument to emit a high-pitched tone. The frequency excursion of the tone is an approximate measure of the concentration of explosive vapour sampled; the source can be located by passing the probe across the area from which the response was obtained and listening to the variations in response. When desirable, the tone can be fed through the earphone so that it is audible to the operator only. A red light, which is visible to the operator but not to the person being searched, also appears when a strong sample is obtained. The PD4C is powered entirely from its own 12V rechargeable battery pack which is connected to the unit by a quick-release, weatherproof connector.

**Variants:** The military version is PD4M.

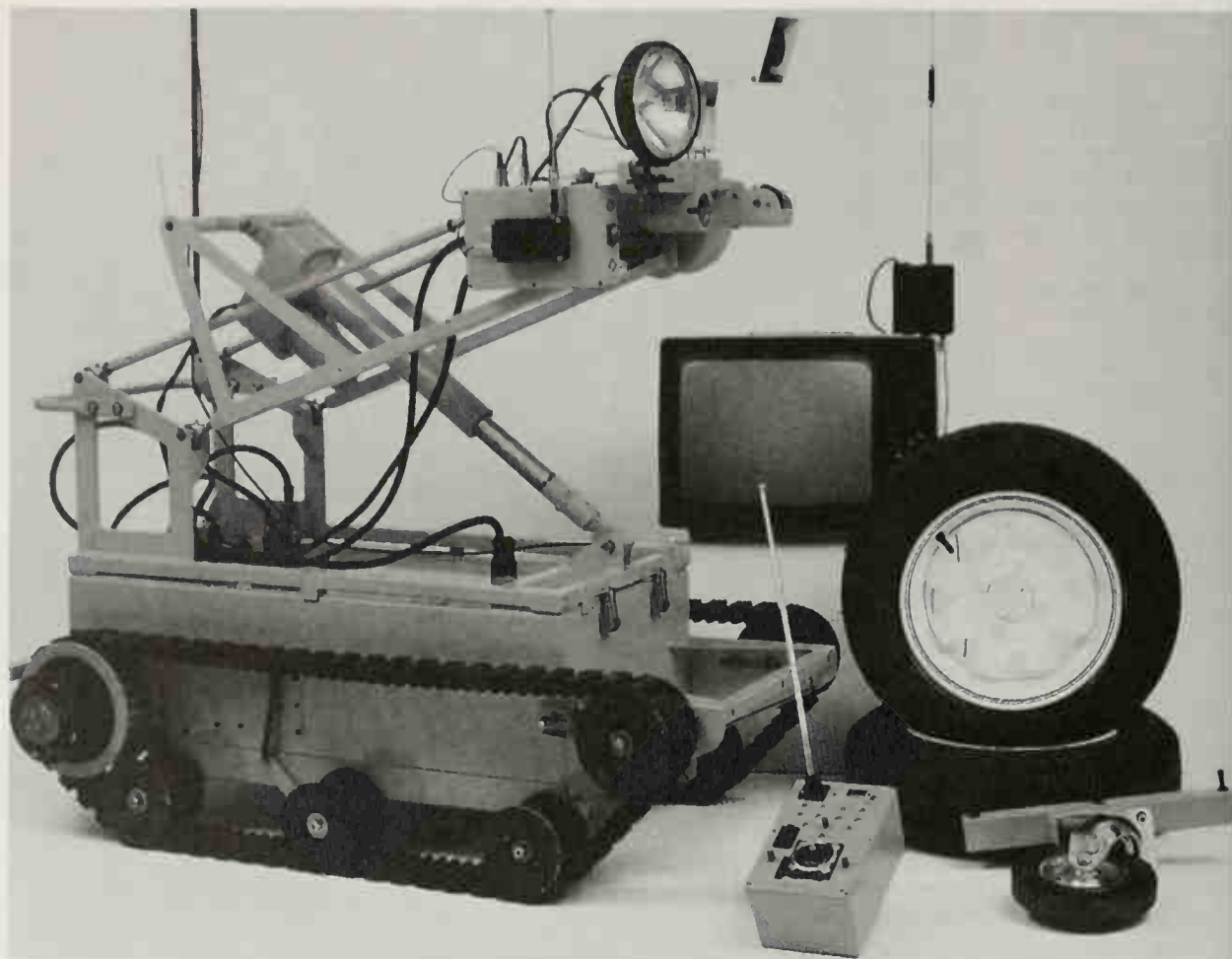
**Employment:** Numerous civilian organizations.

**Data:** weight 4.1kg (case), 0.75kg (hand unit); dimensions 43cm × 32cm × 11cm (case), 33.7cm × 6.7cm × 5.0cm (hand unit); operating limits 4–5 hours (constant use), 8–12 hours (normal intermittent use).

### **HED Explosives Detector Type L3A1**

HED is a hand-held, battery-operated equipment used to search vehicles, aircraft, freight containers and such for the presence of military, commercial and other explosives. HED will detect explosive materials within closed metalwork such as car doors and sills, and will also search inside interior walls, floors, and ceilings without the necessity of physical disassembly. Since HED operates by the detection of hydrogenous materials, it can also be used to search for drugs and other commodities of local value. The equipment consists of a hand-held probe connected by a single cable to an electronics unit, which is carried on the person. The probe, mounted on a lightweight telescopic arm, contains a small radioactive source and a neutron detection chamber. The whole equipment is stored in an aluminium carrying case, which contains a special polyethylene shield for the probe head and room for a supply of consumable parts such as batteries and probe covers. The radioisotope emits energetic neutrons, which pass through all matter. These energetic neutrons are scattered by hydrogen in their path, reducing their energy considerably. The low energy neutrons are detected in the probe, and a signal sent to the electronics unit, which contains all the controls, the input socket from





**Above:** The Hunter Remotely Controlled Vehicle, showing its alternative wheeled and tracked configurations. (See also page 54.)

the detector, a meter display, and an audio output socket for the earphone. The battery is fitted under a removable lid.

**Data:** *dimensions* 78.5cm × 38.5cm × 34cm (carrying case), 19.5cm × 13.4cm × 9cm (electronic module); *length* of probe unit 1.23m (extended); *weight* 35kg (total), 1.6kg (probe unit only).

### Hunter Remote-Control EOD Vehicle (Series 3)

A joint Hunting Engineering and SAS Group venture, the remotely controlled Hunter robot was developed by experienced EOD officers to be as flexible and simple to operate as possible. Special features include an exceptional degree of control at slow speeds, constant power at all speeds, single fingertip control and two articulated arm mountings for several combinations of equipment, including shotguns, disruptors and up to three cameras. The equipment is intended for use in a wide range of operations in addition to its primary

EOR/EOD role (fire fighting, anti-hijack, natural disasters and hostage situations, for example). Extra capability available includes radio control, foam delivery, X-ray and an electronic stethoscope. Standard attachments are car hook, scissors grip, grapnel, scoop, nail gun, and tilting arm (mounting shotgun-disrupter, window breaker, charge dropper, camera panning unit). The Series 3 includes the unique combined wheel and track TRAVADS system.

**Employment:** In use with many military organizations around the world.

**Data:** *weight* 115kg; *width* 0.65m; *length* 1.25m; *height* 1.3m (with boom raised); *speed* 30m/minute (approx.); *range* 100m; *endurance* c.2 hours; *power supply* two 24V batteries.

### Kentree Hobo Remote EOD Robotic Vehicle

Developed from 1976 in response to the demand from the Irish Army for a remotely



**Above:** The Hobo EOD Robot. This is an example of one of the larger EOD remotely controlled vehicles; it has an impressive lifting capability and can deal with larger devices.

controlled EOD vehicle, Hobo is modular in construction to afford ease of maintenance and repair. The six wheels provide good manoeuvrability over difficult terrain, and a torsion system prevents overturning when negotiating obstacles exceeding the height of the wheels. The machine is controlled by cable or by radio via a console in a ruggedized transit case. All standard explosive ordnance disposal tools can be used, including shotgun, disruptors, X-ray, sniffer, microphone, acoustic detector, car towing, telescopic boom, etc.

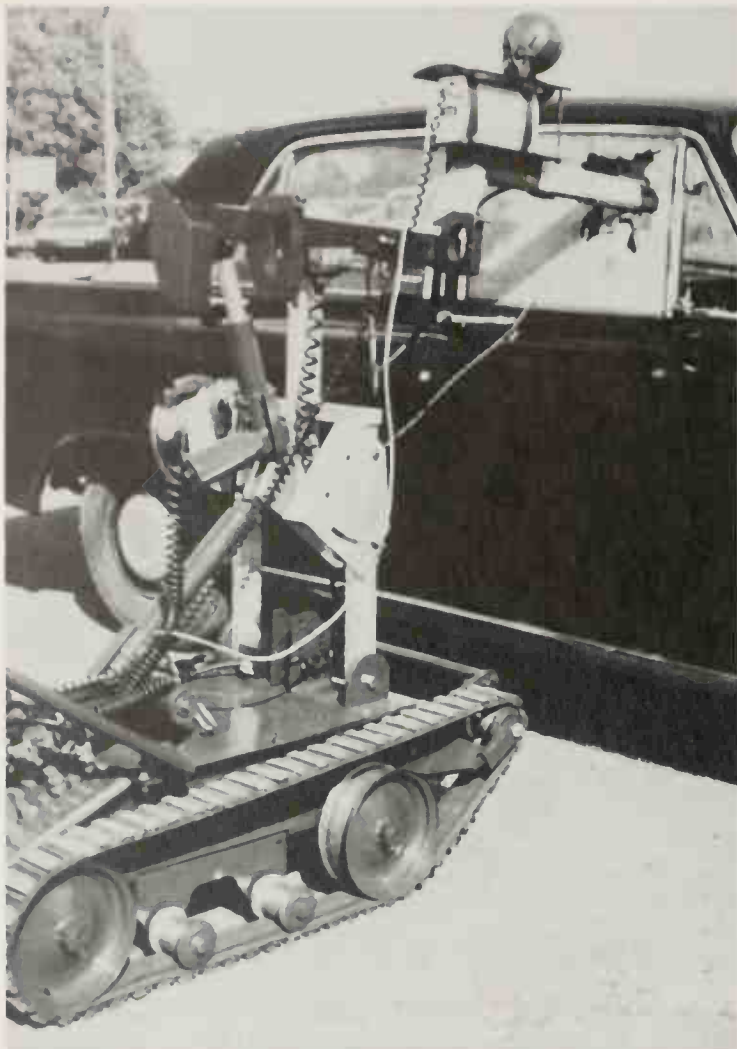
**Employment:** Marketed by the British Royal Ordnance.

**Data:** length 1.47m; width 0.7m; height 0.88m; reach 1.5m; weight 228kg; lifting capacity 75kg (arm unextended), 30kg (arm extended); speed 0-4.8kph infinitely variable; turning circle within its own length; maximum gradient 45°; rotation of turret/arm 220° left/right; power 24V DC 55 amp-hours batteries; endurance 1-3 hours on batteries alone; cable

length 150m; drive 6-wheel independent electrically driven traction tyres.

### **Morfax Wheelbarrow Remotely Controlled EOD Vehicle**

**Wheelbarrow Mk 7:** The concept of this vehicle first saw operational service in 1972. It was developed in order to perform many of the functions that previously placed members of IS forces at considerable risk, and is capable of handling a variety of equipment necessary for the locating and disposal of potentially dangerous objects. The vehicle is powered by two reversible electric motors, running off inboard 24 volt batteries. The vehicle carries vertical and horizontal booms for locating various manipulating items. Wheelbarrow has a remotely controlled CCTV camera and panning head, allowing the operator to control his vehicle from a safe position using a TV monitor. Commands are transmitted to the vehicle by means of a detachable 100m 18-volt control cable. The



**Above:** Wheelbarrow Mk 7 operating in Northern Ireland, dealing with a suspected car bomb. The arm mounting a camera is allowing remote surveillance of the interior of the automobile for identification and diagnosis of the device.

EOD operator can now attack virtually any Improvised Explosive Device he encounters, and if he runs out of time it is a machine that is damaged, not a man killed. However, experience has shown that rarely is a Wheelbarrow totally destroyed in an explosion. The application of Wheelbarrow is not limited to EOD work. With the multi-purpose central mount (MPCM) it can carry and automatically fire a variety of weapons used in riot, hostage or 'shoot-out' situations. There is a comprehensive range of attachments available.

**Employment:** Various US police forces, British Army.

**Data:** weight 195kg; width 0.69m; length 1.22m; height 0.82m (with boom folded); speed 33.5m/minute; range 100m (standard cable and drum); endurance 2 hours (mean); power supply two 12V 50 amp-hour lead/acid batteries; CCTV single lens (240V 50Hz)



supplied via an inverter; monitor 9in model (12V DC or 240V 50Hz).

**Wheelbarrow Mk 8:** This is the latest version incorporating various improvements on earlier marks. For instance, the stand-off distance for an EOD operator is now up to 300m in an open environment when the vehicle is under radio control.

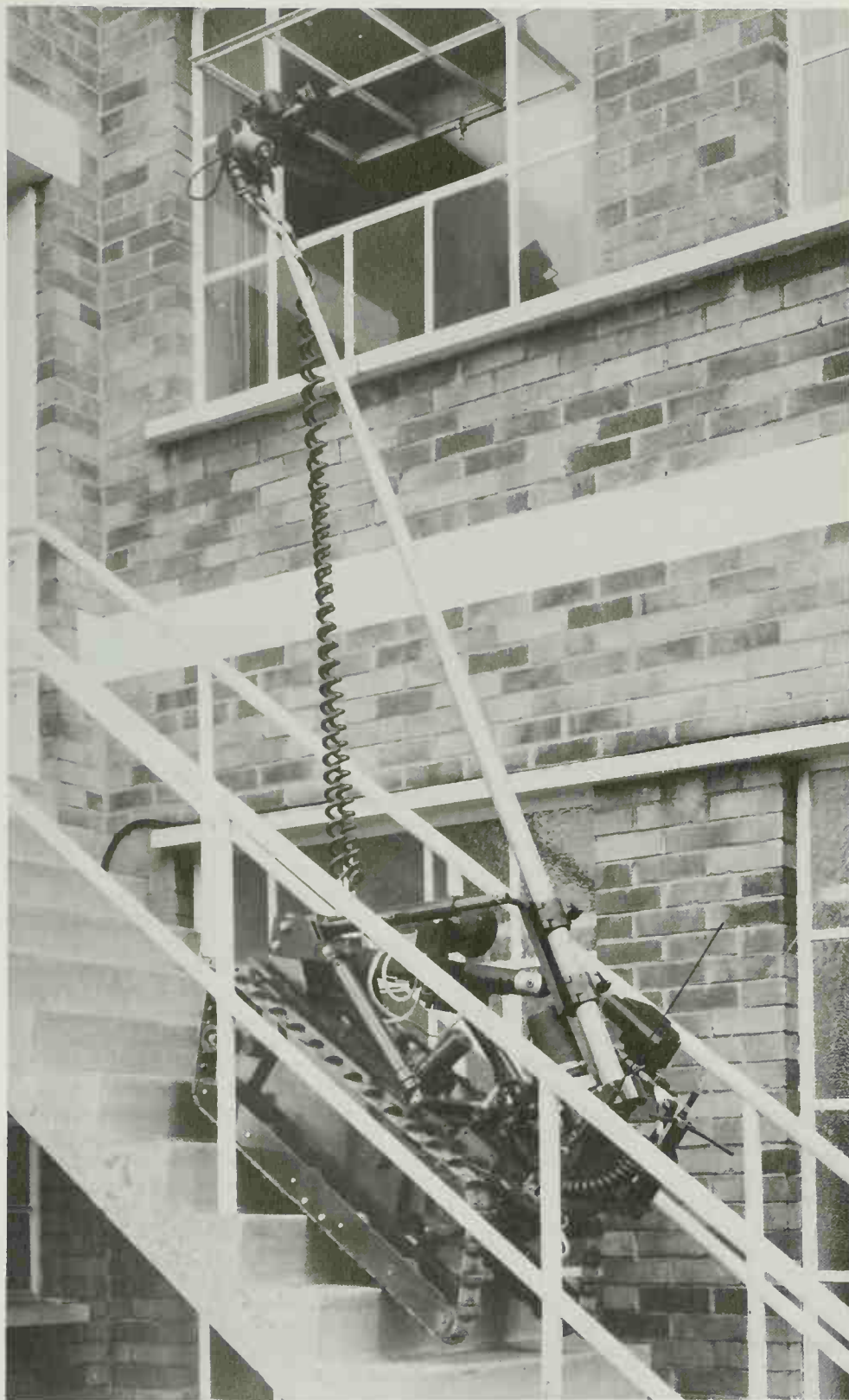
### Plessey Radar Metal Detectors

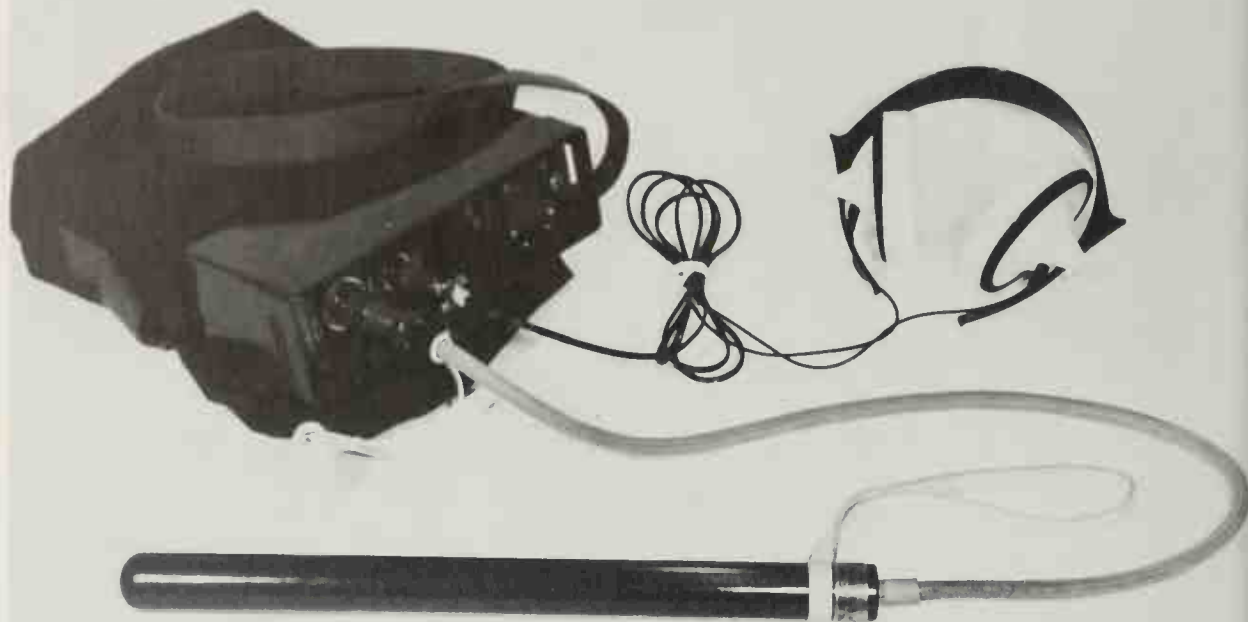
The Plessey P6/2 equipment consists of a waterproof electronic unit and a set of operator-interchangeable waterproof probes. The operating mode is pulsed induction. Target detection is indicated audibly by a loudspeaker or plug-in earphones. Switched sensitivity and response times are provided. Power is from internal batteries or an external source (via an adapter). Four types of probe can be provided as standard, each for a





**Above and right:** Mk 8 is a much improved version as a result of many years of experience with Mk 7 in Northern Ireland. Mobility and stair climbing are better and the vehicle has a more sophisticated remote search system. It is now radio controlled.





**Above:** The Plessey P6/2 Metal Detector.

specific purpose. A connection cable terminated in a quick release plug is integral with each probe; P6A/2 is a tubular ferrite probe suitable for searches in bushes, streams and rugged urban and rural environments. P6E/2 Open Loop Probe is a lightweight probe, for ground search applications. P6F/2 is a short robust probe for general searches in restricted environments. P6G/2 is a light easy-to-use probe designed for the searching of persons. Special probes can be designed for particular applications, e.g., the P6C/2 sledge probe.

**Employment:** United Kingdom (Army).

**Data, Electronic Unit P6/2:** *length* 25cm; *weight* 2.4kg (without batteries); *width* 8cm; *height* 25cm.

**Data, Long Probe P6A/2:** *length* 1.02m overall; *diameter* 3.2cm overall; *point* bullet shaped; *weight* 1.2kg (including cable).

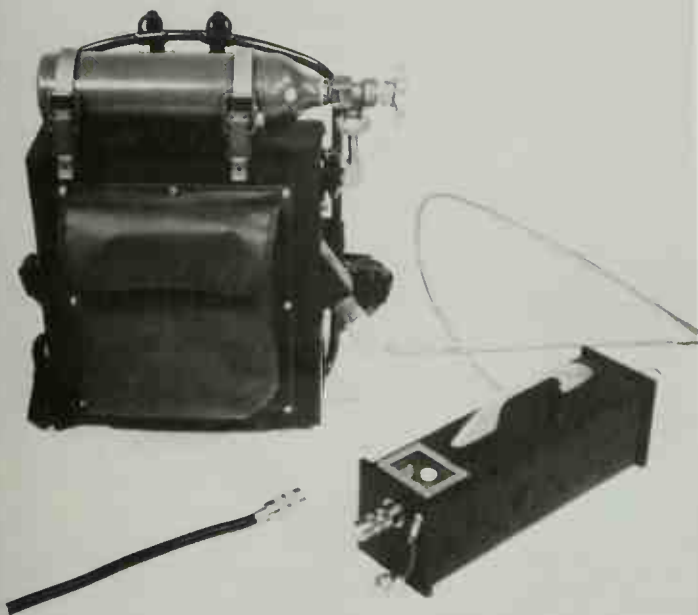
**Data, Open Loop Probe P6E/2:** *length of handle* 1.143m; *inside diameter of coil* 20cm approx.; *weight* 1.6kg (including cable).

**Data, Truncheon Probe P6F/2:** *length* 40cm; *diameter* 3.2cm; *point* rounded; *weight* 750g.

**Data, Personnel Probe P6G/2:** *length of probe* 40cm; *diameter of disc* 9.6cm; *thickness of disc* 2cm; *weight* 500g.

## **Pye EOD Equipment**

**PD1 Explosives Detector:** In 1972 the IRA in Northern Ireland began using explosives in large quantities to manufacture bombs. The British Army asked the Royal Armament Research and Development Establishment to design a unit that would detect nitroglycerine-based explosives, which were then being exclusively used by the IRA. Pye Dynamics were invited to develop and produce in quantity the unit designed by RARDE. This became known as PD1. The equipment is carried and used by one man. It consists of a hand unit, a back-pack mounted on a standard carrying frame, and an interconnecting cable. The hand unit contains the analysis unit with its associated electronics, and incorporates a display panel which indicates correct functioning of the equipment by means of light signals. The back-pack contains the control electronics, a rechargeable nickel-cadmium battery and a light alloy bottle containing Argon gas. In operation the probe is placed in areas or against objects suspected of containing or bearing traces of explosives. A sample of air is drawn into the hand unit and analyzed for the presence of explosive vapour. A



**Above:** Pye's PDI Explosives Detector, which has been in wide use throughout the world and has seen valuable service with the British Army in Northern Ireland.

positive response to this causes an audible alert to sound. The alert is available either from a loudspeaker in the back-pack or in an earpiece. Controls are limited to on-off switches for power, gas and lamp display. There are no operator adjustments and effective use of the equipment requires little training. The detector responds to vapour concentrations of one part in several million parts of air. This sensitivity is such as to give positive responses from hands, clothing and containers many hours after contact with explosives. The detector is unaffected by large concentrations of most commonly encountered vapours such as cleaning fluid, petrol and cosmetic sprays. This results in an extremely low incidence of false alarms. The detector is supplied with various probes suitable for different search situations.

**Employment:** The Pye PDI Explosives Detector is in use in Bahrain, Barbados, Bangladesh, Brunei, Canada, Czechoslovakia, Denmark, Egypt, Germany, Iraq, Italy, Kenya, Korea, Libya, Malta, Netherlands, New Zealand, Nigeria, Philippines, various countries in South America, Saudi Arabia, Spain, South Africa, Sudan,

Sultanate of Muscat and Oman, Syria, Switzerland, Taiwan, United Arab Emirates, United Kingdom, United States. It is used by military and police, private industry, government organizations, airlines and airport authorities.

**Data:** weight 17kg; back pack dimensions 11cm × 31.5cm × 45cm; hand unit dimensions 35cm × 10.5cm × 16.5cm; continuous operating limit 6 hours.

**Stethoscope:** This diagnostic equipment has been developed to facilitate the audible detection of active clockwork-type fuse mechanisms, which may be encountered during Explosive Ordnance Disposal operations. The equipment has been designed to operate in a temperature range of -30°C to 70°C. It permits the concurrent monitoring of a known or suspect device by two operators, a search operator and a stand-off operator, either listening to an active clockwork mechanism or warning that a mechanism once stopped has restarted. The equipment has been adapted and marketed by the SAS Group of Companies and is known as the SA94 EOD Stethoscope.

**Data:** control unit dimensions 25.5cm × 10.5cm; control unit weight 2.4kg; headphones weight 0.46kg.

## Rapidex Screening Systems

**Hand Baggage Screening System:** Developed by International Air Radio Ltd specifically for screening hand baggage, the system uses not only X-ray examination techniques to detect weapons and detonating devices, but also incorporates as an optional additional facility an explosives detector based on the design originated by the Royal Armaments Research and Development Establishment for the British Army.

**Employment:** British Airways and other international airlines.

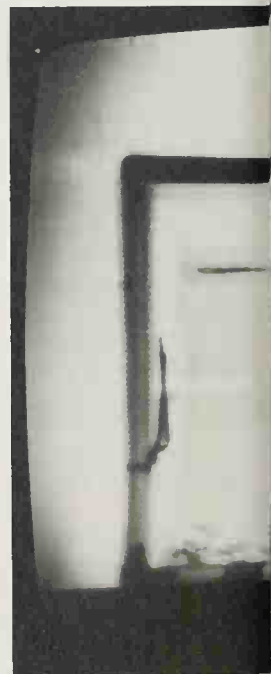
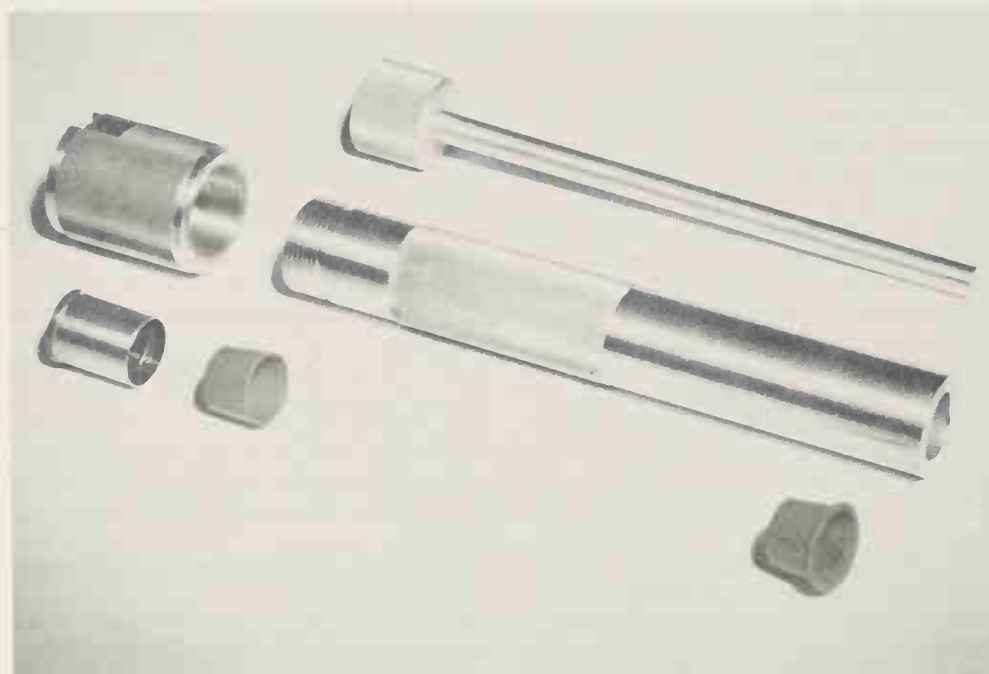
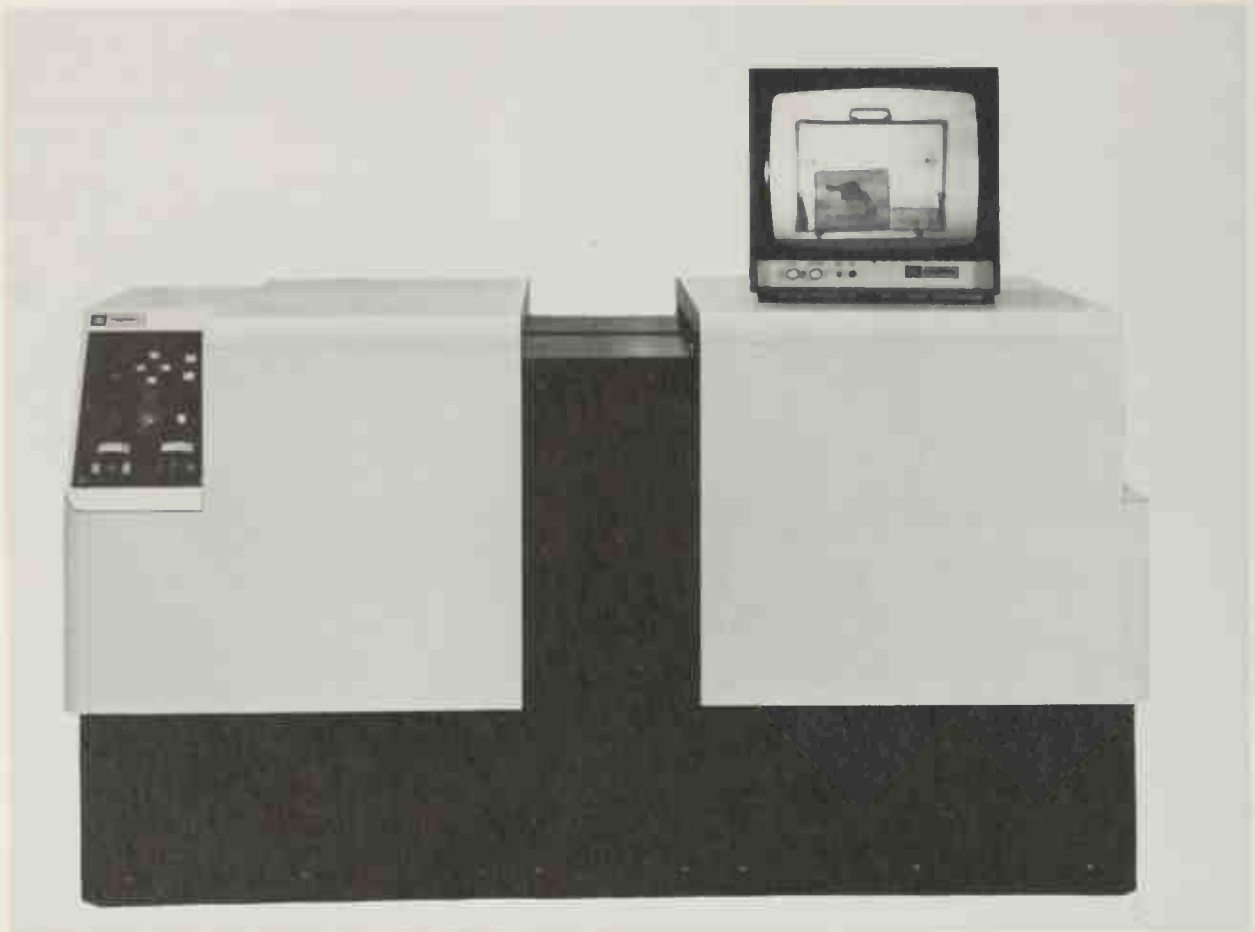
**Data:** weight 630kg; length 1.96m; width 99cm; height 1.16m; maximum baggage size 81.3cm × 61cm × 30.5cm.

**Metal Detection Gateway:** The control panel that contains alarm indications, sensitivity adjustment meters and power switches is, in the standard version of the gateway, located in the overhead span of the unit. The control panel can be sited remote from the gateway if required.

**Employment:** United Kingdom and several other countries.

**Data:** weight 50kg; depth 45.7cm; width 88.9cm (overall), 68.5cm (gateway); height 2.18m (overall).





**Top left:** The Rapidex Hand Baggage Screening System, an example of a standard X-Ray equipment.

**Below left:** S&D Security's Model 1840 Disruptor. The disruptor is the most common method of disarming IEDs without causing them to explode. The aim is to disrupt the associated timing mechanism by means of a precisely aimed, controlled explosion.

**Below:** A positive result. The X-Ray view of a find, showing a handgun and other metal objects, all of which show up clearly.

**Above right and right:** S&D Security Inspector X-Ray system, showing the primary unit (above) and the processing unit (below).



### S&D Security (Equipment) EOD Equipment

**EOD Disruptor Model 1840:** Made of high tensile aluminium. Model 1840 comes in a lightweight carrying case with 15 cartridge sets. The Disruptor can be fired from sandbags, from its own lightweight stand or from Wheelbarrow-type systems.

**Data:** weight 3kg (in case), 8kg (stand); length 285mm; breech diameter 47mm; barrel diameter 38mm; carrying case 400mm × 280mm × 70mm; stand height 1.15m (fully extended).

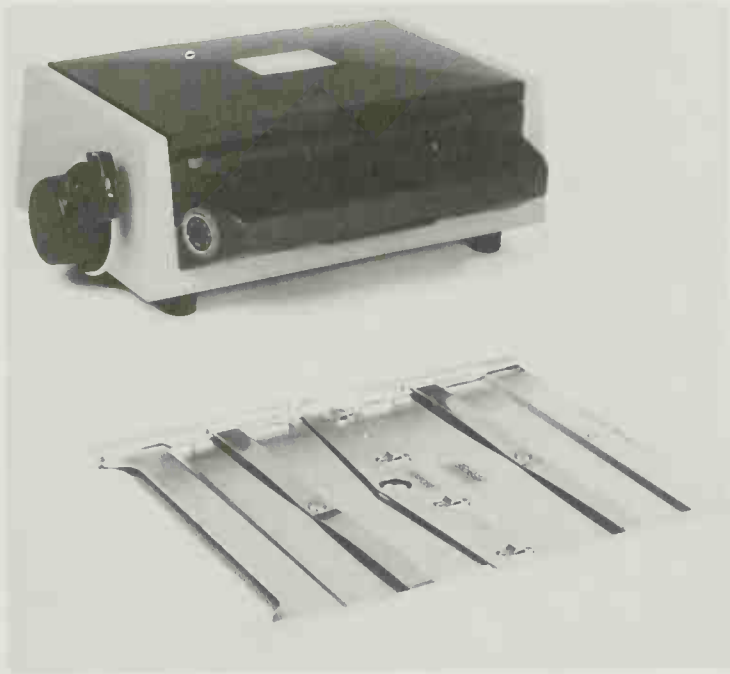
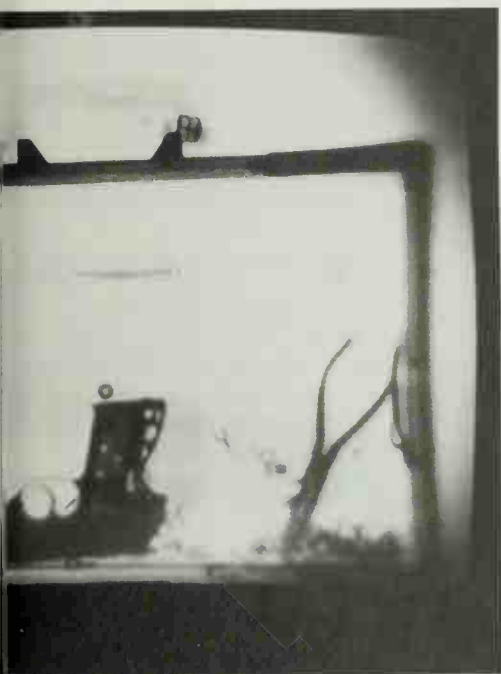
**Inspector:** An advanced portable X-ray system for checking suspicious packages, looking through car doors, etc. The system can operate in full sunlight and without any

mains power. The kit produces 4in × 5in positive radiographs on standard black and white Polaroid film.

**Employment:** Inspector is in use in many countries with military, police, customs services and private commercial companies.

**Data:** dimensions 380mm × 175mm × 115mm; pulse rate 20 per second; beam angle 40°; weight 9kg (inspector), 15kg (film equipment).

**Scanna Letter Bomb Detector LP 9000M:** An easy-to-operate letter bomb detector with a negligible false alarm rate. It can screen bundles of letters, packets and parcels up to 16 inches thick at rates up to 9,000 per hour. It will detect virtually all known letter bomb





detonating devices, but it ignores harmless stationery items such as paper clips, staples, pins and tags.

**Variants:** This equipment is also marketed by the SAS Group of Companies as the SA128 Electronic Letter Bomb Detector.

### SAS Developments EOD Equipment

**Disruptor SA91:** The SA91 disruptor and its associated cartridges make use of space technology and explosive ordnance disposal experience to produce a really lightweight but effective method of dealing with most normal types of improvised explosive device. Although it only weighs 440g and is filled with plain water, the SA91, when initiated either on the ground, or from a remotely controlled system, has proved to be thoroughly effective against terrorist explosive devices.

**Data:** length 2.7cm; diameter 3.7cm; weight 0.44kg; water capacity 100cc.

**Portable Battery-Operated X-Ray Equipment SA93:** A compact, fully portable X-ray system, this incorporates a novel type of high voltage pulse generator developed by the United Kingdom Atomic Energy Authority. The SA93 is designed for use without the need for an external power source, being powered by internal rechargeable Nickel Cadmium batteries. It can also be used directly from a mains electrical supply. The supply to the high voltage generator can be selected to provide four different exposures, which give varying degrees of target material penetration.

**Data:** dimensions 17.5cm × 23cm × 38cm (main unit); weight 12.5kg (main unit), 24kg (total); penetration to 50mm.

**Portable X-Ray Unit SA59:** A compact, fully portable, battery operated pulsed X-ray unit designed for use by security forces, this produces positive radiographs in seconds using a Polaroid system of processors. The SA59 consists of a main X-ray unit, incorporating a battery pack and all controls, a battery charger, a remote control switch with 7m of cable and a separate safety plug to prevent accidental use. This is all packed in a strong carrying case with 4in × 5in Polaroid cassette/processor. It may be used from a Hunter robot using the Hunter control system.

**Data:** dimensions 3cm × 10cm × 14cm; weight 8.9kg; power 240/115V, 50/60Hz; battery NiCad 31V DC; output 120–150kV (adjustable); pulse duration approx. 50 nanoseconds; flash rate 1,200–1,500 per minute; beam angle 45°; exposure controls 0–999 (pre-set, adjustable); operating temperature range –15°C to 50°C.





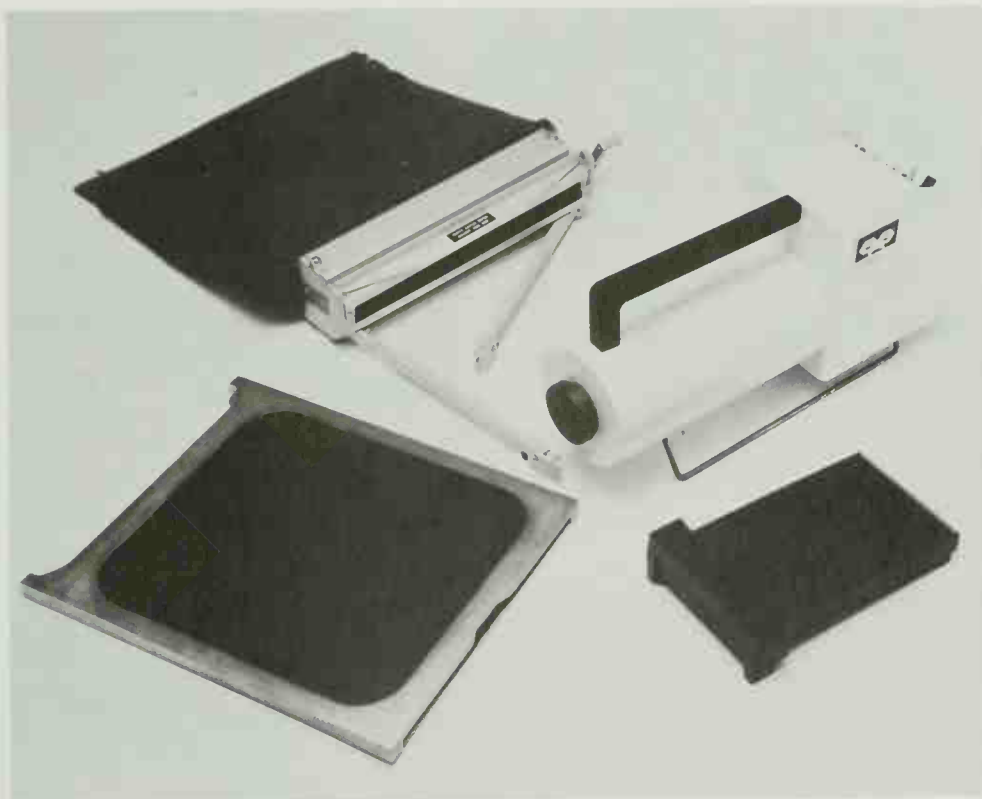
**Top left:** The S&D Scanna Letter Bomb Detector Model LP 9000M.

**Centre left:** SAS Developments SA91 Disruptor.

**Bottom left:** The SA93 Portable X-Ray Equipment.

**Above right:** The SA93's cassette and processor.

**Below right:** The SA59 Portable X-Ray Unit. This is a smaller, more compact alternative to the SA93. It is configured so that it can be used on EOD remotely controlled vehicles, particularly the Hunter.





**Left:** SAS Developments' Bomb Blanket.

**Below:** The Security Systems International Endoscope.

**Bottom:** Security Systems International's Fibrescope system. This is essentially a flexible endoscope associated with a CCTV system to provide remote real-time monitoring.

## Security Equipment Supplies Bomb Disposal Equipment

**Bomb Blanket:** Intended to be placed over a suspicious object, such as a letter bomb, this comes with a stand-off ring to avoid contact with the bomb.

**Data:** size 2.2m<sup>2</sup>; *composition* ballistic nylon; *weight* 7kg.

## Security Systems International EOD Optical Equipment

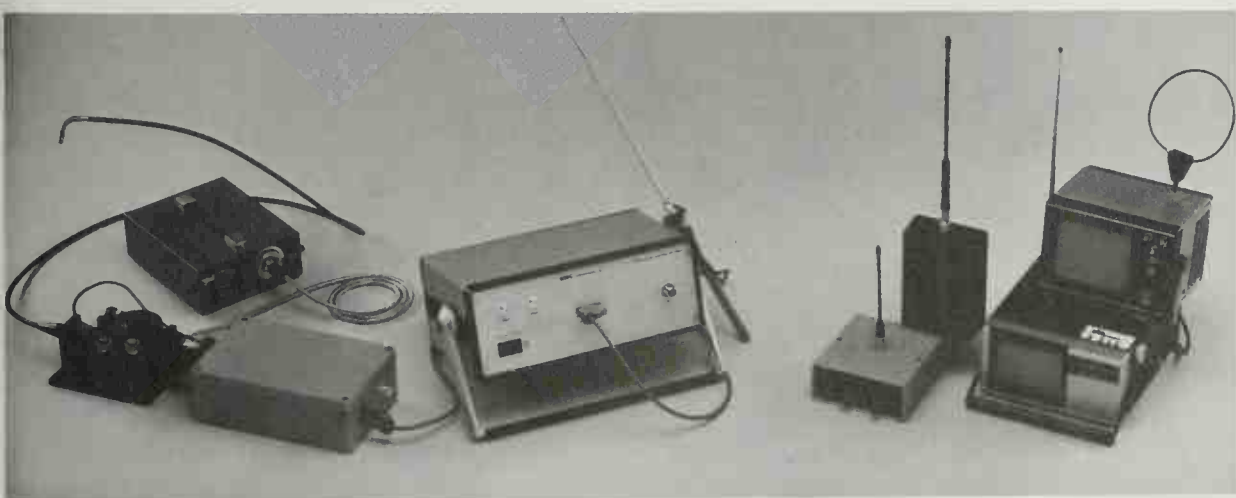
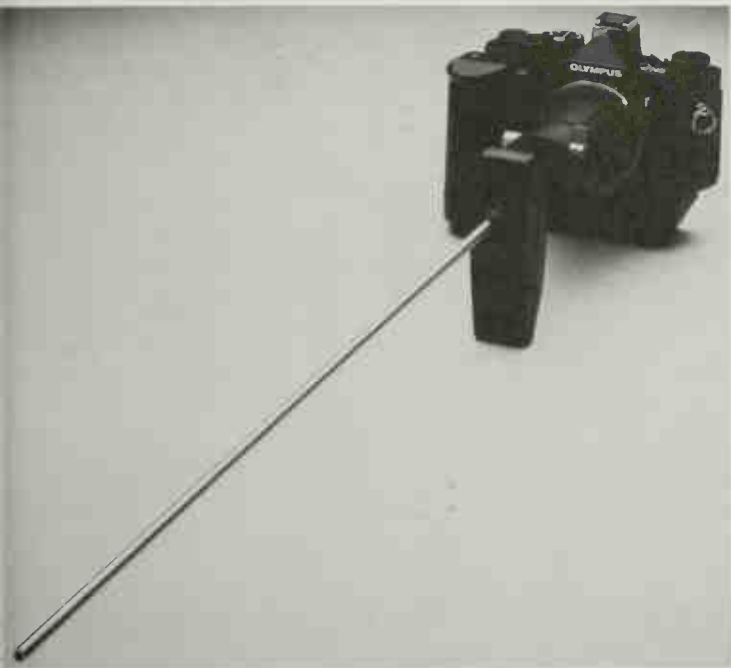
**Endoscope:** For attachment to still cameras, motion picture cameras and video cameras, this supplies the facility to take photographs through small holes in packages, through

keyholes or observation holes in terrorist siege operations.

**Flexible Fibrescope:** A flexible medical fibrescope converted for surveillance use with radio control remote operation, TV picture transmission and built-in illumination. Used for examining suspect containers or vehicle boots for explosive devices from a safe distance; also for remote observation from parked vehicles.

## Security Research Broom

Broom has been developed by Security Research of Guildford as a non-linear detector designed to locate concealed, active, passive or remotely activated surveillance devices and time-controlled and remotely activated IEDs. Such devices must contain at least one semi-conductor, and transistors, diodes and other solid state devices respond to their radio signals or electro-magnetic fields. Broom is designed to detect components, whether or not the device itself is actually operating, such as: attachments to telephone or mains cables, high impedance devices, induction loop systems, the receivers that activate devices, transmitters of all types, tape recorders, wired microphone systems, timing devices and remotely activated receivers. The most time-consuming part of a surveillance detection operation or sweep is the physical search for devices that are not operating at the time – devices such as remotely activated transmitters, dormant devices operating at predetermined times, devices buried in walls, behind panelling, or attached to wiring. There also may be transmitters with batteries that are at the time too low to produce a detectable RF signal. Broom also has uses in body searches and other non-destructive searches.





**Below:** The Security Research Broom 'bug' detector

**Right:** The Simtec portable Explosives Detector in operation.

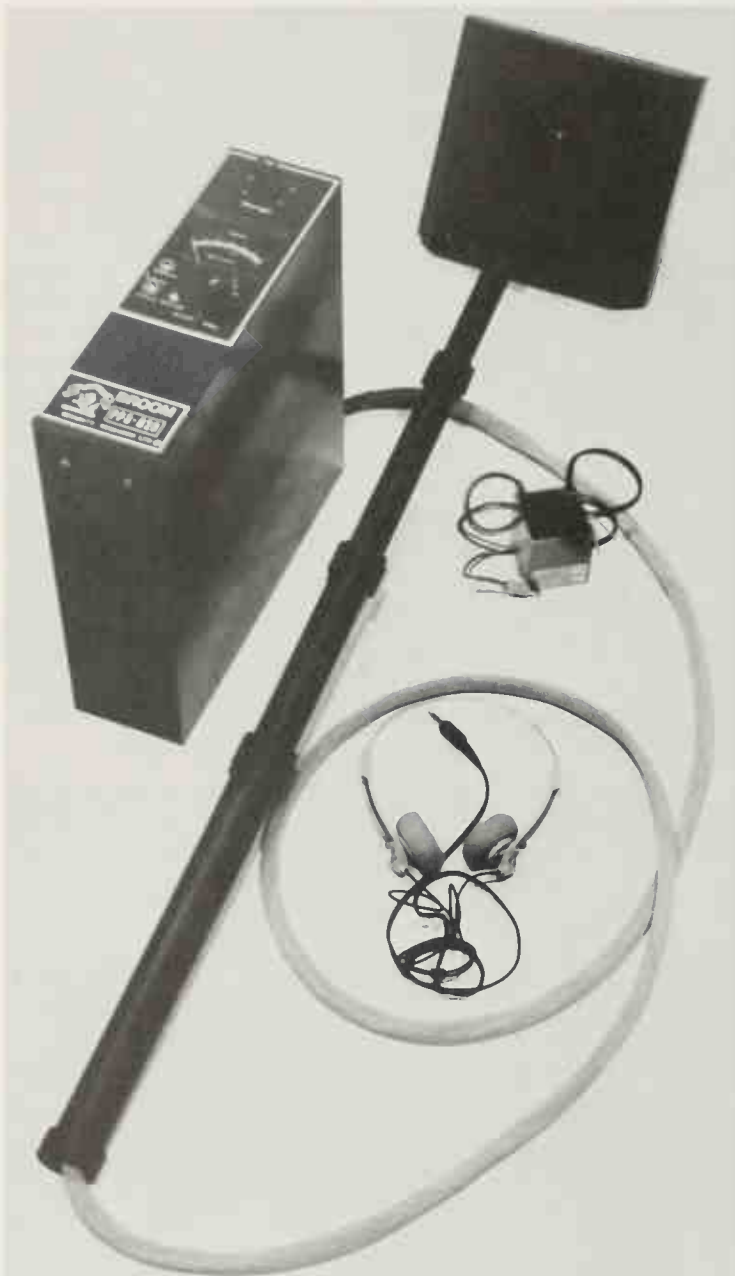
For EOD applications, if RF activated IEDs are suspected, Broom can be first taken towards the suspect object on a robot, although recent experience shows that timing devices are becoming more frequently used. The equipment is lightweight and simple to operate, even by non-professional personnel. The control unit contains integral rechargeable batteries, and visual and audible indicators. An extendable antenna-detector is used to sweep over walls, ceilings, floors and furniture; this is lightweight to minimize

operator fatigue. Since Broom is not a metal detector it does not react to innocent objects such as screws, nails and other metalwork. The principle Broom uses was originally researched by the Admiralty Signals Establishment in an entirely different connection as long ago as 1947; it is therefore an entirely British system but uses very novel and state of the art technology. It is quite different from existing non-linear junction detectors, which can now be defeated by RF flooding.

**Data:** length 25.5cm; width 7.5cm; height 24.1cm; weight 5.5kg (with leather case).

## Thorn EMI Simtec Portable Explosives Detector

The Simtec Portable Explosives Detector is a highly sensitive and specific man-portable detector that can detect very small concentrations of nitroglycerine- and nitrobenzene-based explosives. The detector can also be set up to detect TNT. It comprises a back-pack unit and a hand-held probe, these being connected by an umbilical cable and sampling tube. The hand unit supports the sampling probe and includes the primary controls and indicators. The back-pack unit includes sample processing modules, battery, gas supply and secondary controls and indicators. A chromatograph and electron-capture detector are used for sample analysis. The chromatograph separates the sample vapours into their constituent parts, and these are fed to the electron-capture detector. This detector is gated to ignore interfering agents and alarm only to specific vapours, a method that results in a very high sensitivity coupled with high selectivity, providing a very low false-alarm rate. Both visible and audible alarms are provided on the hand probe, and the audible alarm can be switched off if required. The only other indicator on the probe is a 'system operational' light. A single control, to start and stop sampling, is mounted on the hand unit. The back pack includes the main case, to which is mounted a small gas cylinder, these being enclosed in a haversack which also houses the NiCad battery power supply. Following extensive trials with the British Army, the Ministry of Defence has awarded a contract worth over £60,000 to Thorn EMI Simtec for production quantities, the first major order for this detector, which was launched at the British Army Equipment Exhibition in June 1984. The company claims it is the world's most sensitive portable explosives detector and that it is at least one order of magnitude better in this respect than other portable equipment on the market.

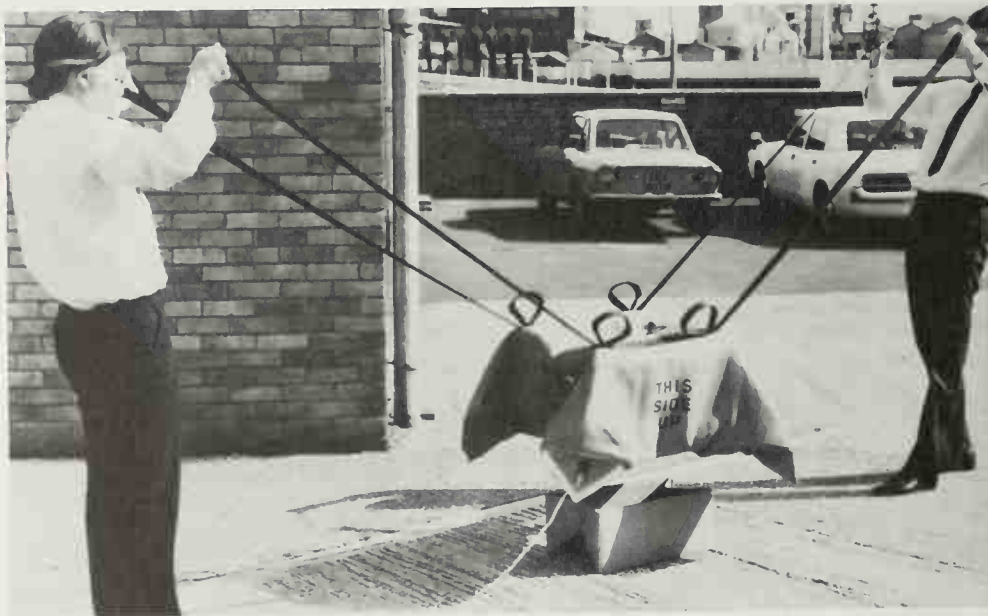


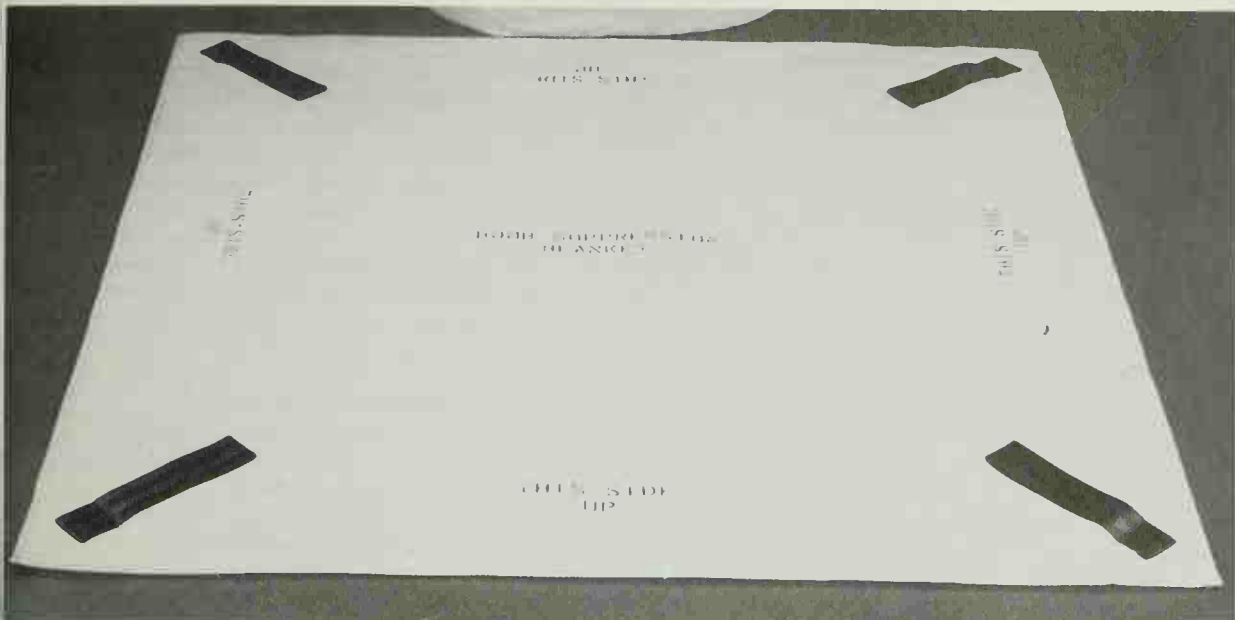




**Above and right:** The deployment of Volumatic's Bomb Suppression Blanket, with special frame to prevent the blanket touching or pressing upon the suspect device.

**Opposite page:** American Body Armor's equivalent equipment. The lower illustration shows the Safety Circle device, which both prevents contact of blanket with suspected bomb and helps to contain low velocity splinter in the case of an explosion. It also deflects blast upward into the blanket.





*Data: height 420mm; width 430mm; depth 195mm; weight 12.25kg (with gas cylinder and battery); power 12V NiCad battery (2 hours endurance) or 0.39-litre nitrogen gas cylinder (6 hours endurance); temperature operating range -20°C to 40°C.*

### **Vomatic Bomb Suppression Blanket**

Made of a specially designed ballistic nylon with fire resistant coating, the Vomatic Bomb Suppression Blanket will contain blasts from home made bombs of varying size and design. Its 1.5m<sup>2</sup> of coverage provides full protection, yet the blanket is light enough (7kg) to be carried by one man. In high magnitude explosions, the blanket rises to a parachute configuration, while the sides drop, so containing the blast.

**Employment:** Libya, South Africa, Zambia.



## **UNITED STATES OF AMERICA**

### **American Body Armor Bomb Suppression Equipment**

**Bomb Suppression Blanket BSB-1:** Made of Kevlar and ballistic nylon, this weighs 21lb and is 4ft × 4ft in size. The BSB-2 weighs 32lb and provides a slightly greater degree of blast suppression.

**Safety circle:** Safety circles are used in conjunction with bomb suppression blankets. The device is placed around the suspect device. A blanket is then placed over the



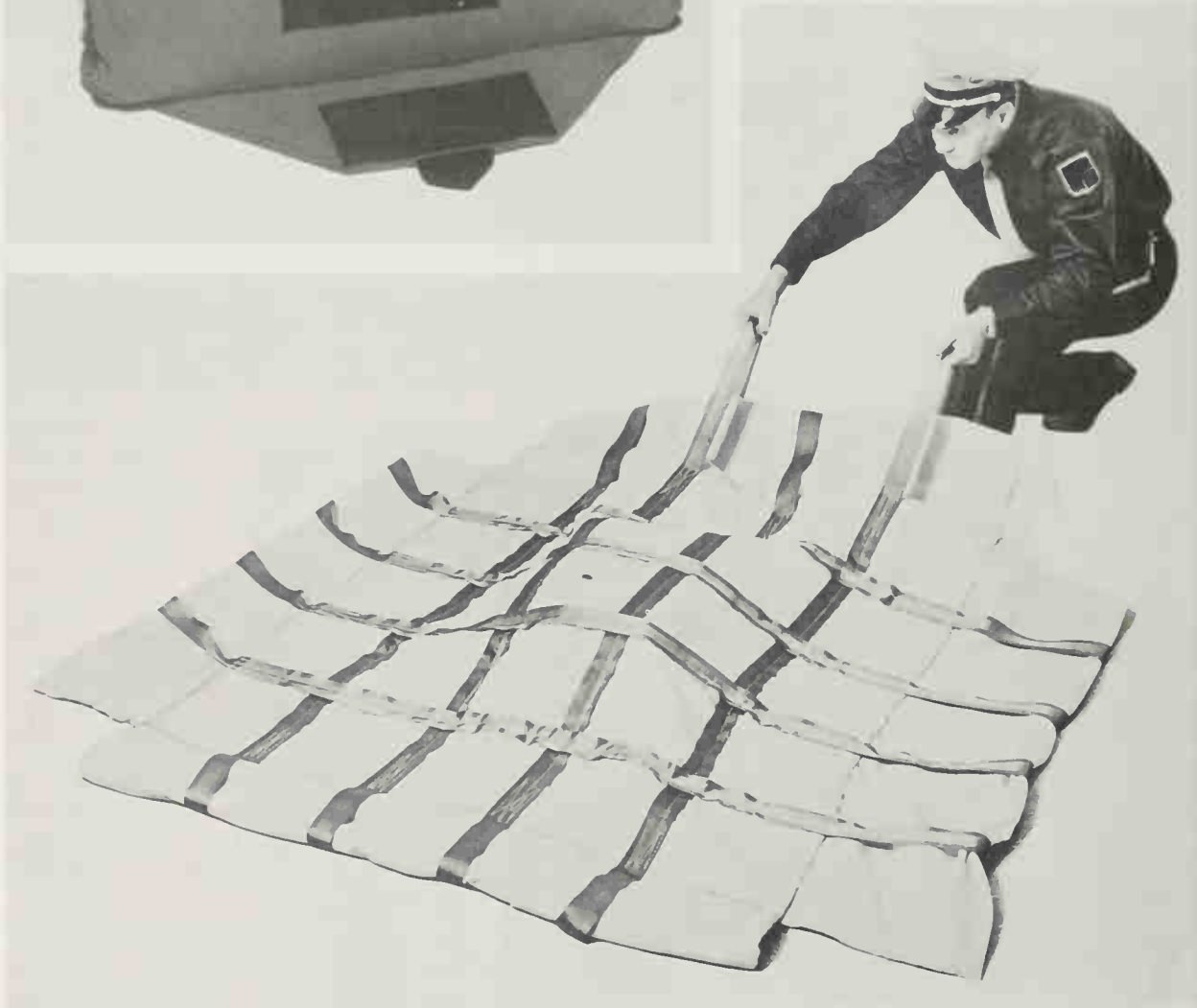


circle and bomb, ensuring no contact is made with the device. Safety circles weigh 15lb and are 17in  $\times$  72in.

**Letter Bomb Suppression Pouche:** Constructed of Kevlar and ballistic nylon, weighing 15lb, size 17in  $\times$  18in  $\times$  5in, the Pouche is used to enclose a suspect letter; it is then dragged by the 16ft nylon lanyard provided to a safe area. US Government Tests have shown that the blast from an explosion caused by 3oz of explosive was reduced from an average of 9.6psi to an average of 1.6psi and shrapnel was contained.

### **Burlington Bomb Blanket**

The Burlington Industrial Fabrics Co. has developed a bomb blanket constructed of ballistic nylon. It measures 2m  $\times$  2m, and weighs 27kg. Burlington claim that the blanket has effectively suppressed the explo-



**Top left:** American Body Armor's Letter Bomb Suppression pouch.

**Below left:** The Burlington Bomb Blanket, another manufacturer's version of the equipment shown on the previous spread.

**Below:** The Chem-Devil vehicles. The photograph illustrates a novel approach to hazardous munitions disposal, introduced at the Dallgny Proving Grounds in Utah, USA, in the 1970s. It is thought that the vehicles are still used for disposing of dangerous munitions on the ranges.

sive force of a pipe bomb charged with 0.35kg of smokeless pistol powder. In further tests, using three sticks of 60% dynamite, it has contained the explosion with minimal damage to the building in which the test took place.

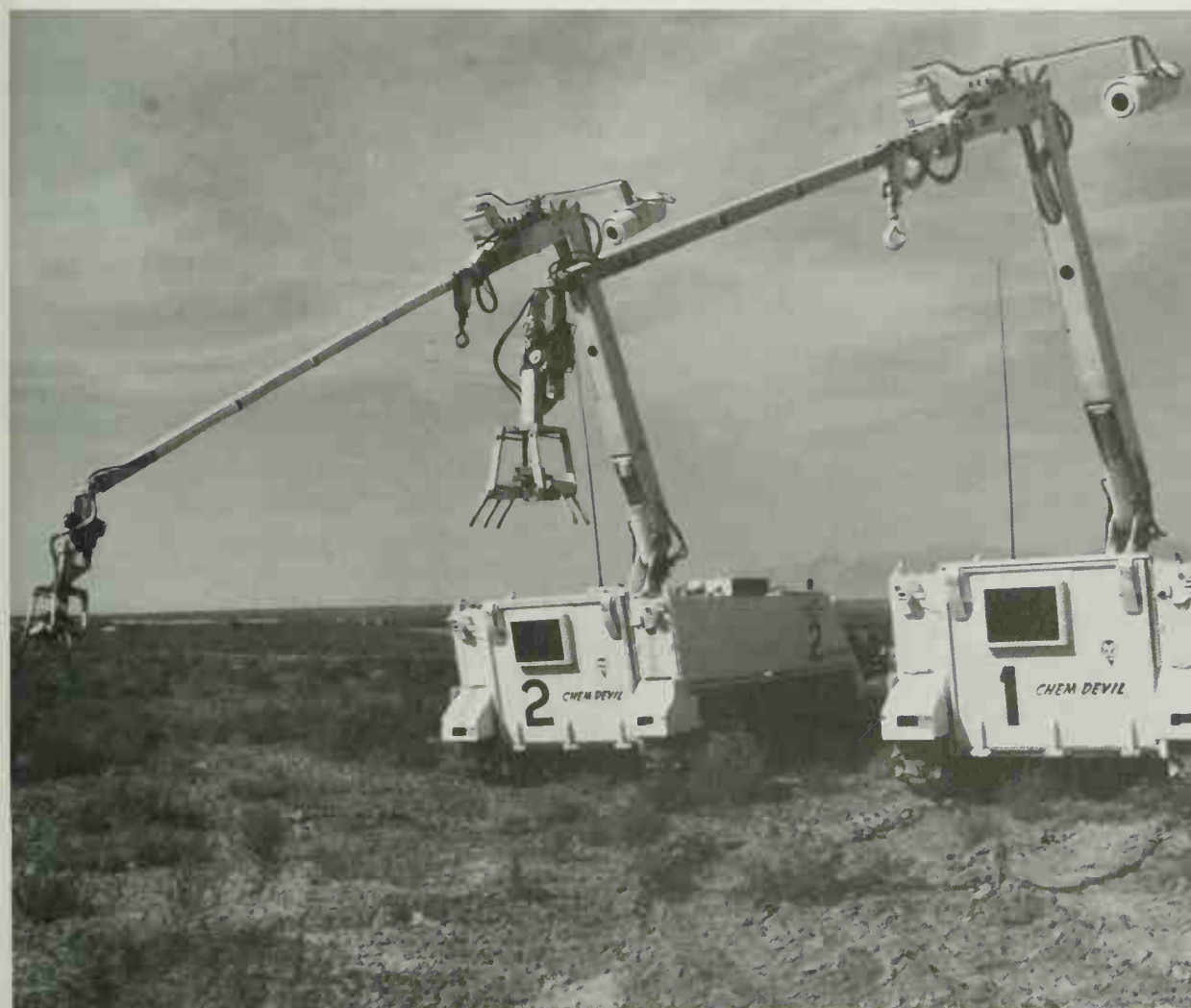
### **Munitions Support Directorate Bomb Disposal Equipment**

**Chem-Devil Hazardous Munitions Disposal Vehicle:** Designed and first built in the early 1970s, these vehicles are now in daily service and are operating at or beyond their design parameters. A highly modified commercial hydraulic loader crane has been mounted on the inner floor and extends through a specially designed 360° flexible seal mounted in the roof. The crane has a reach of 8.2m and a lifting capacity of 226.8kg. Two TV cameras are provided for continuous viewing of disposal operations by the crew. A ballistic

window is also provided for direct viewing. The control console incorporates features that permit the crane operator to drive the vehicle. The crew compartment has been fitted with air conditioning and air filtration systems. Both vehicles have been coated with a highly reflective white urethane paint to reduce crew compartment temperature and to keep the outside surface free of hazardous substances. Radio communication between vehicles and a command post and TV transmission systems are part of the on-board electronics.

**Employment:** Although both vehicles are thought to be still employed at the Dugway Proving Ground, they are available for use by police or army units.

**Total Containment Bomb Trailer:** In 1976 the Munitions Support Directorate at Picatinny Arsenal delivered a trailer mounted explosive blast containment vessel to the FBI Bomb





**Above:** The Total Containment Trailer developed by the Munitions Support Directorate at Picatinny Arsenal. This is suitable for removing small explosive devices to a safe area; the fact that there is no venting of the explosive forces must, however, severely limit the size of bomb that can be contained.

**Right:** The SE1 FSL-8 SWAT Light.

Data Program. The vessel is spherical to withstand explosive forces yet with minimum wall thickness and to equalise these forces in all directions, so that relatively lightweight support and trailer suspension can be used. The vessel is a 91.4cm diameter steel sphere with approx. 1.9cm wall thickness and includes a 45.7cm diameter opening with externally hinged door. A replaceable centring support is furnished to position the explosive inside the sphere, and a captive net can be used remotely to place the explosive in the vessel and then remove it remotely at the disposal site. The complete assembly weighs approximately 544.3kg.

**Employment:** USA (FBI).

### **Communications Control Systems Letter Bomb Detector LBD400**

LBD400 screens mail electronically. Letters fed through a gate are analyzed for the presence of explosive materials, electrical triggering devices or any other ferrous elements used in the construction of a letter bomb. When the magnetic field is disturbed by the presence of a threatening device, the instrument alerts the operator by two optional warning systems – the LED alert, a silent

alarm in the form of a discreet light, and a tone alarm that produces a shrill noise. A calibrated control permits adjustment to different levels of sensitivity. Designed for continuous operation, LBD400 can be operated by an individual without previous technical training.

**Employment:** In use in the US, Africa, Asia and the Middle East.

### **Protective Materials Co. Bomb Disposal Equipment**

**Bomb Disposal Trailer PA-T-200:** The Protective Materials Co. of Andover, Massachusetts, has developed this trailer for the transportation of suspected bombs, near-critical volatile substances, or dangerous chemicals. The trailer carries the suspected bomb in a net suspension system. If any explosion should occur, the blast is vented upward and away from the towing vehicle and its crew. The trailer has a remote loading system to place the suspected bomb in the carrying net.

**Variants:** The T-100 Bomb Disposal Trailer is designed to be towed by almost any car or light truck.

**Employment:** Various US police forces.

**Data:** weight 2,631kg (with sand); length

3.25m; width 2.13m; height 1.72m; maximum safe speed 70mph; brakes electric or hydraulic; capacity safely vents 50 sticks of 40% Dynamite; containment vessel double-walled and double bottom, stress-relieved, with full penetration welds.

**Bomb-Handling Sled Bombthret PA--B300:** To minimize personnel exposure during the approach and initial handling of suspected explosive devices, this bomb-handling sled has been developed. The shield is designed to deflect the blast and fragmentation likely to be encountered should the suspect device detonate prior to being placed in a secure container. The sled chassis is mounted on locking swivel castors in the rear and rigid castors in front, which allows free movement on virtually all floor surfaces. The shield face, sides and bottom are constructed of PM-1200 armour materials. The large viewpoint is a transparent non-fragmenting composite, designed to equal the ballistic capability of the shield. The shield face is curved and severely canted rearward. 'U' slots are provided at the top of the shield face to allow operation of telescoping a prosthetic tool for lifting and placement of the suspect device.

**Bomb Suppression Blanket Bombthret PA-600:** Made of specially designed ballistic nylon with fire resistant coating, the Bombthret Blanket will contain explosions from a large variety of bombs. Sixteen square feet of coverage provides substantial protection, yet the Bombthret Blanket is light enough (11.3kg) to be carried by one man. In high magnitude explosions, the blanket rises to a parachute configuration while the sides drop to contain the blast. In the event of an overmatch, the Bombthret Blanket will 'fail safe' – that is, it will not contribute any additional hazard.

### SEI Inspection System

The FSL-8 SWAT light was developed by SEI of Fullerton, California, for the inspection of dark areas. It is particularly suitable for looking under vehicles. With its 70,000 or 110,000 candlepower spotlight and 12V battery pack, the equipment provides a powerful light for one hour (or 30 minutes in the case of the 110,000 candlepower spotlight).

**Variants:** The 65001 Inspector is 762mm long and weighs only 0.56kg. It is designed for use in confined spaces.

**Employment:** Various US police forces.

**Data:** length 1.37m (collapsed), 2.44m (extended); weight 1.14kg (excluding battery); battery pack weight 4.53kg.





# Anti-Riot Weapons and Equipment

This book is concerned primarily with the fight against terrorism, and the equipment and weapons necessary for the defeat of the gunman and bomber. However, terrorist situations often arise out of (or are associated with) civil unrest. Large and often violent crowds are now commonplace almost everywhere in the world. In Eastern Europe, the Czech, Hungarian, Polish and East German authorities have all had to contend with serious rioting. The race riots of the 1960s and since in the USA have posed a serious threat to law and order. Belgium, Holland, France (in particular the student riots of 1968), West Germany and even Switzerland have all experienced serious street violence during the 1970s and 1980s. In South America, India and in parts of South East Asia it is almost endemic. In South Africa black protest on the streets has, ever since Sharpeville, continued relentlessly. The Japanese take their riots very seriously – students manage to equip themselves very nearly as well as the police, which leads to pitched and prolonged battles over relatively minor issues, such as the siting of an airport or the closure of a road. In Great Britain recently there have been the Bristol, Toxteth and Brixton race riots and the miners' strike of 1984/5; and in Northern Ireland riots and street violence of varying intensity has continued since 1969. It is of course the right of every citizen in a democratic society to protest peacefully and by means of organized marches and meetings; sometimes, however, such gatherings get out of hand and have to be controlled by the police. There is no suggestion that such disturbances in any way equate to terrorist activity. Anti-riot weapons and equipment, however, are manufactured by the same companies that produce other types of IS equipment. They should, therefore, be included in this book.

Anti-riot weapons and equipment include 'tear' (CS) gas grenades and launchers, PVC rubber projectiles, tear gas generators, various aerosol CS gas dispensers, riot shotguns, sniper rifles, batons and shocksticks. The use of CS gas by security forces entails the wearing of gas masks, a selection of which

are also included in this section. (Vehicles are, of course, often involved in a riot situation, and specific adaptations of vehicles such as water cannon are covered in the section on vehicles.)

In a riot situation it is usually preferable for troops or police to maintain a reasonable distance between themselves and the crowd. This prevents the security forces being overwhelmed or outflanked, and tempers tend to remain cooler if a sensible distance between the two sides is maintained. This is not always possible and, when close contact is unavoidable, the most common means of crowd control is the wooden baton or truncheon. It is not intended to cover batons in this chapter except for a recent development of the baton, the shockstick, which gives an uncomfortable, though not dangerous, electric shock. Resembling a rolled-up umbrella in appearance, when the cover is removed and the stick switched on, it emits a loud crackling noise. At the same time blue static sparks flash up and down the spiral element.

CS grenades can be thrown by hand or fired from a variety of anti-riot weapons, including shotguns, grenade launchers and conventional rifles. Many of these anti-riot weapons can also fire anti-riot projectiles of various sizes and materials. Both rubber and PVC projectiles are available and are designed to counter petrol bombers or stone-throwing crowds up to a range of about 60m and to cause no more than bruising or shock. They should not be used at very close range. Baton rounds do have the advantage of being selective, while CS smoke is not: in extreme situations, CS gas is a very effective crowd disperser, but affects bystanders, adults and children and (if they are not equipped with gas masks) rioters and security forces alike. Crowds all over the world have become adept at wearing wet handkerchiefs over their faces to combat the effects of the gas, and have learned to throw or kick the grenades back at the security forces. Nevertheless, CS gas is an extremely effective way of dispersing a crowd. The gas causes extreme discomfort to the eyes, nose and breathing passages, yet has no serious or lasting effects. It can

**Right:** Today's policeman is formidably equipped for anti-riot operations. Beneath his overalls he wears body armour; shins and forearms are additionally armoured, and his helmet is specially designed to withstand impact from missiles and bullets. His visor protects the face, and a gas mask allows him to continue operations while the opposition are handicapped by CS or CN gas. One of the more spectacular aspects of his armoury is what looks at first glance like a large toy pistol. This is Excalibur, a multi-shot riot gun from SES. It can fire the complete range of 37/38mm anti-riot munitions and the chamber holds 5 cartridges. The gun weighs 4kg and is 76.5cm long. 300 of these have been sold to Malaysia and negotiations are in hand with several other countries.



be dispensed from a grenade, by means of an aerosol spray or from a vehicle-mounted or hand-held generator.

Although not an anti-riot weapon as such, the stun or distraction grenade fits most easily into this chapter. The stun grenade first came to the public's attention in the October 1977 Mogadishu hijack when the SAS provided technical assistance (including stun grenades) to the German anti-terrorist force GSG 9. They were also used in May 1980 by the SAS during the storming of the Iranian Embassy. The purpose of the grenades is to shock the terrorist into temporary inactivity and to distract him while entry is gained to the building or aircraft in which hostages are being held. The grenades produce one or more loud detonations and a blinding flash. The grenade body is usually made from card or rubber and contains flash-powder of varying types. Although stun grenades are designed to be non-lethal, the premature detonation of some types could severely injure the thrower. They are much like the British Army's training grenade, the Thunderflash, which can blow a hand off if the thrower does not get rid of the device the second he has ignited it. Many manufacturers in the UK, France, Germany and the USA now produce stun grenades. The British Army stun grenade used by the SAS is a classified item of equipment and is therefore not illustrated in this volume.

In some situations, for instance when snipers use a crowd as cover from which to fire at troops or police, security forces have no alternative but to use rifles or

shotguns at carefully selected targets. There are countless manuals providing comprehensive coverage of all small-arms, and it is not the intention of this book to duplicate that detail. However, in some circumstances, such as in a hijacking or kidnapping incident, it may be necessary to use highly accurate weapons to avoid injury to innocent bystanders. Some sniper rifles especially designed for this purpose are therefore included in this section. Shotguns are also used in some riot situations to fire lightweight polyethylene pellets, which at about 25m are not able to penetrate a sheet of newspaper but at 3–15m have an impressive deterrent effect.

The Metropolitan Police in London have invested in expensive anti-riot equipment in recent years. The Home Office has three public order surveillance vehicles nicknamed 'hoolivans', which are Ford Transit vans, each containing two television cameras and a 35mm photographic system mounted on a periscope and backed up by a pair of video monitors. The vans have been used for monitoring football crowds and are useful for VIP escort and security duties. It has also developed evidence-gathering cameras, which are mounted on tripods and capable of providing both still photographs and videos. They have proved to be an effective deterrent against football violence. The cameras (of which the Home Office has two at present) are especially designed to produce high-quality pictures even in poor light. The London Metropolitan Police also have three helicopters equipped with television cameras, which they can use against rioters if necessary, while





protected vans with reinforced corners and window grills carry officers to the scene of a riot. Communication during riots is a major problem and the 'Met' has 10,000 two-way radios to enable police units to keep in touch. Powerful searchlights are also necessary after dark for taking photographs and enabling officers to see what is happening. (See separate sections dealing with vehicles, surveillance systems and communication systems.)

Police forces around the world use varying degrees of force to disperse a riot. In some countries the army is automatically called upon; elsewhere, as in the UK, the Police are used and the Army is only called in as a last resort. Many countries have formed special so-called 'third force' organizations, specifically to deal with riots and other IS problems. Examples are the Compagnie Républicaine de Sécurité (CRS) in France and the Federal Border Guard in West Germany. (Had such an impartial and well-disciplined force existed in Northern Ireland in 1969, would it have been necessary to call in the Army?) The philosophy of the CRS in France is diametrically opposed to the British approach of minimum force. In France, maximum force is used at an early stage to demonstrate to the rioter that the authorities 'mean business', and this is intended to deter further misbehaviour. The CRS put down the May 1968 student riots in Paris ruthlessly. The German police use much the same tactics. The British, on the other hand, have always used only the necessary degree of force to meet a given situation, and have escalated their reaction as

necessary. There are arguments in terms of pure efficiency for both approaches.

The Japanese riot squad, the Kidotai, are the most heavily armoured riot police in the world. They are also the toughest and have to be fit enough to operate inside a 14½lb uniform while carrying a 12lb aluminium shield. Their equipment includes wooden truncheons, polycarbonate helmets, wicker-and-metal shields, tear-gas guns, truck-mounted smoke dispensers, water cannon, extending towers that can fill occupied buildings with tear gas and nets strung on long poles for intercepting missiles.

America's anti-riot squads vary from state to state. In Washington, specially trained police are organized in ten-man civil disturbance units, and these are armed with helmet, visor, .38 revolver, tear gas, 3ft-long riot sticks and crowd-dispersing grenades. The National Guard, which reinforces the police, carries rifles, shotguns and riot batons.

In France, both Gendarmerie and CRS carry transparent shields and are armed with rubber truncheons, 9mm submachine-guns, 9mm automatic pistols, 7.5mm carbines and tear gas grenades.

Whatever methods are used by troops or police in riot situations, they will to some extent rely on the type of equipment illustrated in this chapter. No attempt has been made to provide comprehensive cover of anti-riot equipment in service throughout the world – one gas mask or CS grenade looks much like another. Rather, a representative cross-section of the main categories of anti-riot equipment has been chosen.

**Left:** MPRG 83, a typical anti-riot gun capable of firing baton rounds and other cartridges such as those displayed below. From left to right, a rubber bullet and its cartridge; a baton round and cartridge; smoke/signal and shotgun cartridges. Among the latter types are cartridges filled with a lightweight type of shot intended to deter rioters without inflicting serious injury.

**Right and far right:** Handcuffs old and new. Nickel-plated steel, double-locking cuffs from T. L. Elliott; and 'instant' plastic cuffs, a useful lightweight, easy-to-use alternative for temporary application in riot situations.







**Above:** The Steyr AUG Police Universal Semi-Automatic Rifle. It has a shorter barrel than the standard military version.

## AUSTRIA

### Steyr IS Weapons

**AUG Police Semi-Automatic 5.56mm Rifle:** Dubbed as 'the police arsenal in a suitcase', the AUG-P offers a choice of four barrel lengths and converts from submachine-gun to assault rifle with a twist of the wrist. 30- and 42-round magazines are available and the rate of fire can be adjusted from 150 rounds per minute to 680. The magazine is transparent and the gas blow-back operating system minimizes recoil.

**Data:** calibre 5.56mm × 45mm; weight 3.3kg; overall length 6.9m; height 2.8m.

**SSG 7.62mm Sniping Rifle:** With a hooded blade fore-sight and slanted leaf rear sight, the SSG is a bolt-action rifle to which a ten-round magazine can be fitted. Optional features include a double-set trigger for rapid-reaction fire, and a Kahles ZF69 scope.

**Data:** calibre 7.62mm × 51mm; weight 4.5kg (loaded), 4.95kg (with scope); overall length 1.13m.

## BELGIUM

### Fabrique Nationale Anti-Riot Equipment

**CN Gas Aerosols:** The tear gas aerosol, carried in a container fixed to a waist belt or hidden under a garment, is now tending to replace the conventional truncheon. Such aerosols have been designed for use by police forces and also by individuals for self protection. The use of a tear gas aerosol allows the

policeman to avoid any hand to hand struggle while ensuring a rapid though short disablement of his opponent. FN produce two principal types. Aide is scarcely larger than a pencil and, fitted with a stylo clip, it is hooked to the inside of a pocket. It disperses an efficient CN gas cloud at short range. Slightly larger is the Deputy, which provides an effective gas cloud against several individuals. Its capacity is about 70 jets of one second each.

**Variants:** FN produce variants that can send out an accurate jet to a distance of five metres, and can be inserted in locks or underneath doors to dislodge individuals entrenched inside a building.

**CS Gas Grenades:** FN developed a family of CS tear gas grenades for use by police forces. The short time in which they ignite and the intensity of the cloud of gas make it virtually impossible for these grenades to be thrown back by demonstrators. In addition the grenades are made of plastic, the danger of being burned by the melting plastic during the emission of gas providing a further deterrent to the demonstrator.

**Grenade LAC M1** weighs 230g and can be launched by hand, by rifle, or even from certain machine pistols. Its maximum range is 100m. It is the only grenade that can be launched by a rifle, including the Riot Shotgun, without using any special launcher. The dimensions of the percussion shaft and the type of grenade cartridge are varied according to the launcher.

**Grenade LAC M2** weighs approximately 475g and is designed to be fired from a rifle fitted with a grenade launcher. Its maximum range

**Right:** A selection of FN gas grenades and dispensers.

**Below:** FN's Anti-Riot Shotgun, a pump action 12-bore.

**Bottom:** The FN Sharpshooter's Rifle, a 7.62mm sniper's rifle with adjustable telescopic sight and removable bipod.



**Top right:** AlsateX Zig-Zag gas grenades. These have a characteristic, jerky trajectory and jump about on the ground in order to make it difficult for rioters to pick them up and throw them back at security forces

**Below right:** AlsateX 'Gendarmerie' grenades. 1 and 2 are the hand-thrown and rifle-projected versions of persistent effect grenades, 3 and 4 are the hand-thrown flash bomb and tear gas grenade.

**Below:** AlsateX Gendarmerie CS gas grenades. Numbers 1, 2 and 3 are Model 4 rifle or hand projected; the head separates from the base in trajectory. Number 4 is a practice grenade.

is 160m. The grenade cartridge is varied according to the weapon used.

**Grenade LAC M3** weighs 450g and is for throwing by hand only.

**Grenade LAC M4** weighs 400g and can be thrown by hand or fired by a rifle or grenade launcher.

**Grenade LAC M5** weighs 123g and is ignited by striking the lighter on the top cover.

**Variants:** FN also make two tear gas grenades in metal containers.

**Employment:** Belgian and other police forces.

**Gas Mask C607:** The C607 Gas Mask is manufactured for FN by Pirelli. It has been designed specifically for IS purposes: while giving good protection it provides a field of view of vision of 180°. It is fitted with an acoustic membrane to give a speech facility.

**Anti-Riot Police Shotgun:** This pump action shotgun was developed by FN especially for urban operations, and can hit a target of one

square metre at a distance of 20m with a variety of 12-bore cartridges, in particular the 'Dispersante' cartridge for use in riot situations. The weapon is capable of firing the FN M1 tear gas grenade to a range of 100m, and is provided with an efficient anti-recoil pad and a luminescent foresight, allowing easier aiming in the twilight or badly lit streets.

**Data:** calibre 12-bore; overall length 1m; barrel length 52cm; weight 2.95kg; magazine capacity 6 cartridges.

**Sharpshooter's Rifle:** FN developed this for situations in which highly accurate fire is required. With its moderate weight and an adjustable telescopic sight, a good shot can hit a small target at 600m. The weapon has an adjustable sling and a variable butt length, and is normally fitted with the Zeiss Diavari D telescopic sight.

**Data:** calibre 7.62mm; barrel length 61cm; weight 4.9kg (excluding sight); magazine capacity 4 rounds.



## FRANCE

### Alsatex Gas Grenade Equipment

#### Gendarmerie Tear Gas Grenades

**Persistent Effect Grenades:** These two grenades, 56mm in diameter, 200mm in length and weighing 285g (hand grenade) and 250g (rifle grenade), are either thrown or can be projected by rifle up to 100m. They produce a persistent and invisible tear gas cloud.

**Flash or Stun Bomb:** This grenade contains a pyrotechnic composition creating a flash effect on detonation. It can be used to achieve surprise and shock action in a hostage situation. It is 56mm in diameter, 120mm in length and weighs approx. 190g.

**Offensive Tear Grenade:** 51mm × 140mm and weighing approx. 120g, this grenade does not discharge in trajectory. It has a 2.5-second delay when thrown and produces an explosion on impact without fragmentation. The tear gas emission is instantaneous.

**Model F4 Grenades:** The Alsatex model F4 grenades are 56mm × 160mm and weigh 160g, 125g and 175g. They are rifle or hand instantaneous CS tear grenades, composed of two interlocking parts, the head separating from the base during trajectory.

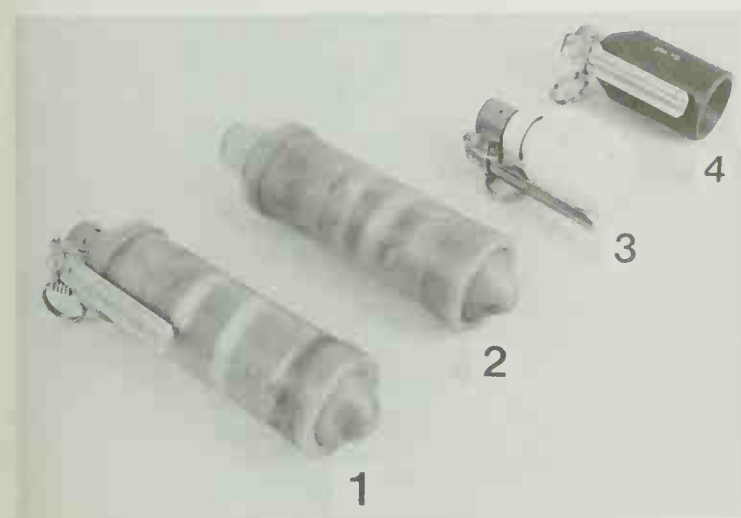
**Employment:** French Army, Gendarmerie and CRS and several other overseas armies and police forces.

**Gendarmerie Zig-Zag Grenade:** The Zig-Zag grenades are 56mm in diameter, up to 252mm in length and weigh up to 320g. They are tear gas grenades designed for use in urban areas, their main characteristic being a cylindrical jacket including a nozzle, which produces jerky propulsion in the air and random jumping on the ground, making the grenade unpredictable and uncatchable. One grenade covers a surface area of 100m<sup>2</sup>.

#### Tear Gas Dispensers

**Individual Tear Gas Dispenser:** Diameter 35mm, height 100mm and weight 50g, the individual tear gas dispenser delivers a jet of tear gas to a range of 4m. Various container sizes are available as well as different concentrations of tear gas.

**1 Litre or 2 Litre Dispenser:** The 1 and 2 litre dispensers deliver a CS gas solution to a range of 12 metres. The 1 litre dispenser has a diameter of 80mm, a length of 400mm and a weight of 2.5kg. The 2 litre dispenser had a diameter of 100mm, a length of 460mm and a weight of 3.8kg. The 2 litre dispenser differs from the 1 litre version in that it has a carrying handle and an additional safety pin.



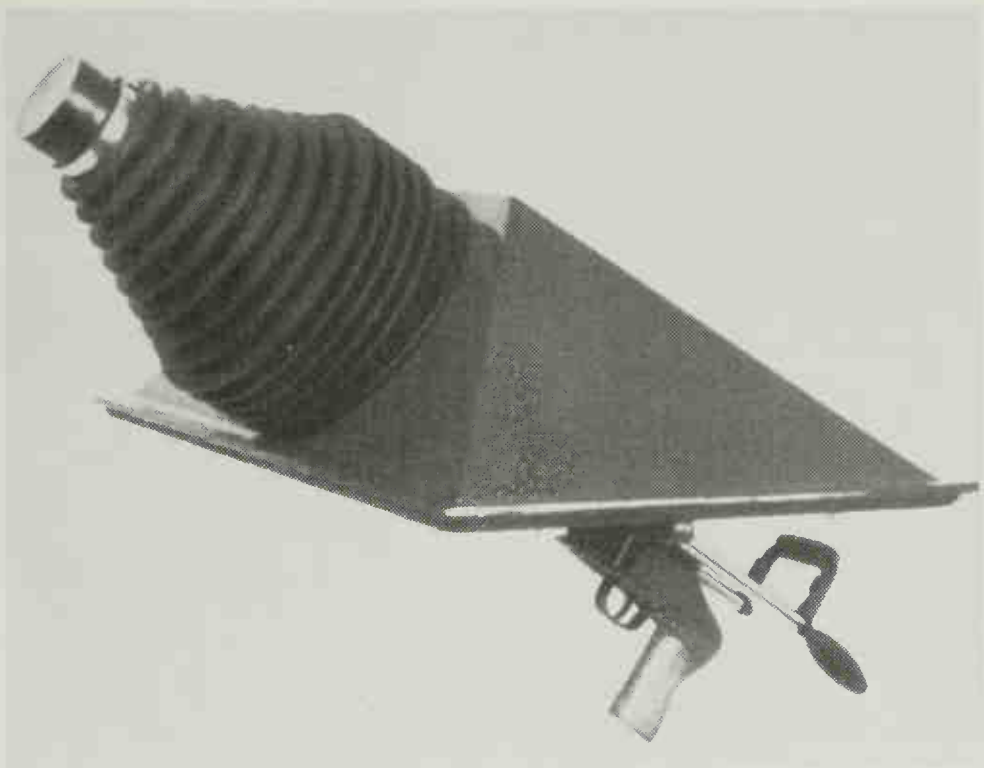




**Left:** The Alsatex grenade launcher is fitted to the MAS36 rifle, used by the CRS.

**Below left:** Alsatex tear gas dispensers. On the left is the individual tear gas dispenser, Alsatex's version of an item often carried in women's handbags in the USA to deter muggers. In the centre are 1- and 2-litre tear gas dispensers and on the right is the back pack unit.

**Right:** The Alsatex Grenade projector Armoured Cowling. This is fitted to the exterior of an armoured vehicle, allowing gas grenades to be discharged from within.



**Back Pack Dispenser:** With a 10m minimum range, this has a diameter of 370mm, a length of 750mm and a weight of 18kg (powder loaded), 21.5kg (liquid loaded) or 16–20kg (gel loaded).

**Tear Gas Grenade Launchers:** Alsatex manufacture a variety of Tear Gas Grenade launchers to project their various types of grenade. These include sleeves mounted on 5.56mm and 7.62mm calibre rifles to project a grenade 100m or 200m (if grenades are fitted with plastic fins). A device based on the MAS 36 rifle can fire grenades 100–350m at a rate of 6 rounds per minute. The total weight of this device is 21kg. A grenade launcher based on the MR 73 revolver can launch grenades 100–350m at a rate of 12 rounds per minute. Total weight is 17kg.

**Grenade Projector Armoured Cowling:** Developed for the Berliet Gendarmerie IS vehicle, it can also be fitted to other IS vehicles. It allows troops to launch CS grenades from within an armoured vehicle by engaging a grenade launcher in the device. It consists of a mechanically welded armoured cowling, which can be fixed to the Berliet Gendarmerie's forward right hatch. Port-holes can be fixed to the cowling if desired for observation and aiming purposes. The cowling and its mounting device are a watertight assembly.

**Employment:** France (Gendarmerie).

**Data:** *armament* shortened MAS 36-51 rifle firing F4 grenades; *rate of fire* 6 rounds per minute; *firing angle* +25° to +55° (elevation), ±50° (azimuth); *weight* 75kg; *range* 200m.

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## FRANCE/GERMAN FEDERAL REPUBLIC

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### Mauser Grenade Launcher

Developed by Mauser for use by the CRS, this is designed to fire persistent and non-persistent CS gas grenades to a range of approximately 100m.

**Employment:** French CRS.

**Data:** *calibre* 7.62mm (rifle), 57mm (grenade); *length* 0.98m (including launcher); *weight* 3.5kg (excluding grenade); *range* 100m.

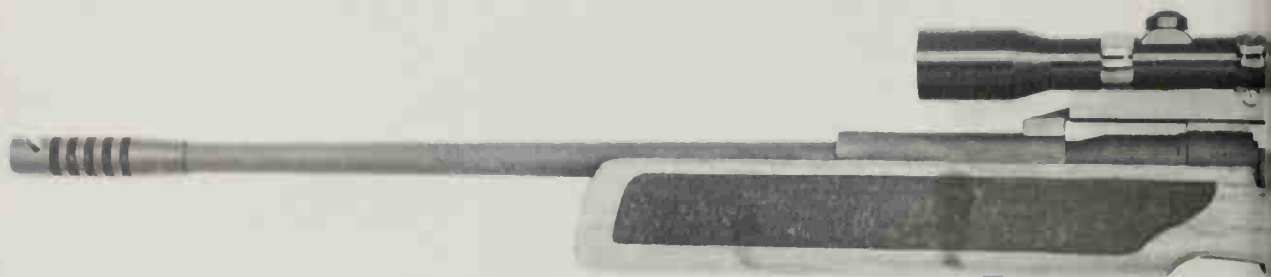
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## GERMAN FEDERAL REPUBLIC

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### Kurt Matter Gas Mask

This gas mask was developed by Kurt Matter GmbH in Germany for IS use. It provides a good field of vision and the microphone, built into the side of the gas mask with a plug-in connection to the amplifier unit, allows the



**Above:** The Mauser SP66 Sniping Rifle, fairly typical of the many specialist sniping rifles on sale to the world's armies and IS organizations.

**Centre right:** Luigi Franchi's PA3/215 pump action shotgun, the smallest gun in the range. With the stock removed, the gun can easily be hidden under clothing.

**Below right:** The Franchi SPAS 15, a gun more military looking than one might expect of a shotgun.

wearer to communicate via the amplifier/loud-speaker without loss of speech volume or distortion and without any extraneous noise. If the microphone is not required, a closure cap supplied with the mask can be used to seal off the microphone opening.

### Mauser SP66 Sniping Rifle

Designed specifically to aid law enforcement agencies in sniper/counter-sniper situations, the Mauser SP66 Rifle is equipped with a muzzle brake and flash hider, and various telescopic sight mountings are available (standard is the Zeiss Davari Z with a variable magnification of  $\times 1.5-6$ ). Each SP66 is fitted with a movable spring loaded cheek piece and an adjustable recoil pad. Passive or infra-red night vision devices can be fitted for use during the hours of darkness in lieu of telescopic sights.

**Employment:** German Federal Republic (Frontier Police, GSG-9).

**Data:** calibre 7.62mm; barrel length 68cm.

## ISRAEL

### Projectojet CS Fog Projector

This tear gas generator was developed in Israel by the Ispra-Israel Product Research

Co. as a weapon for use against groups of violent agitators in narrow streets and alleys. It is a highly effective method of CS gas dispensation. It has a range of 15m in still air, and will neutralize in five seconds any person within three metres either side of the line of fire. It weighs less than 9kg and is rechargeable.

**Employment:** Believed to be in use with Israeli Armed Forces.

## ITALY

### Luigi Franchi IS Shotguns

Italian Gunmaker Luigi Franchi has designed six new shotguns especially for use by military and internal security forces. One of them, the SPAS 15, is currently being evaluated by the Italian Ministry of Defence for issue to special troops. The others are experimental prototypes, far removed from the sporting weapon whose image is usually conjured up by the word 'shotgun' or even from ruggedized versions in police and military inventories.

**Data:** calibre 12-bore; operations gas semi-automatic and manual slide; lock rotating block; length 920mm (overall), 400mm (barrel); weight 3.8kg; feed box, 6-10 rounds.

## UNITED KINGDOM

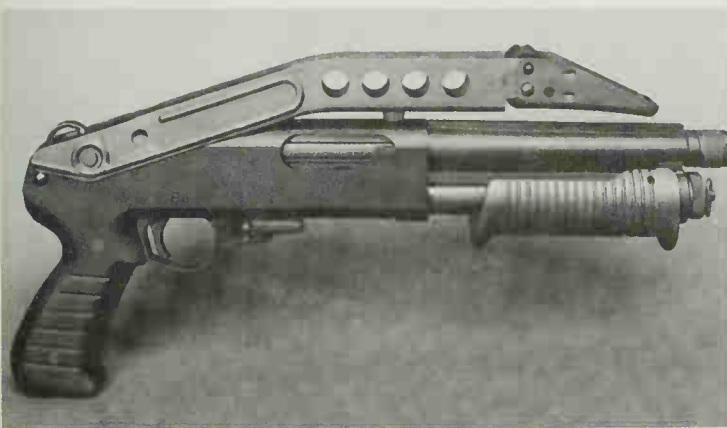
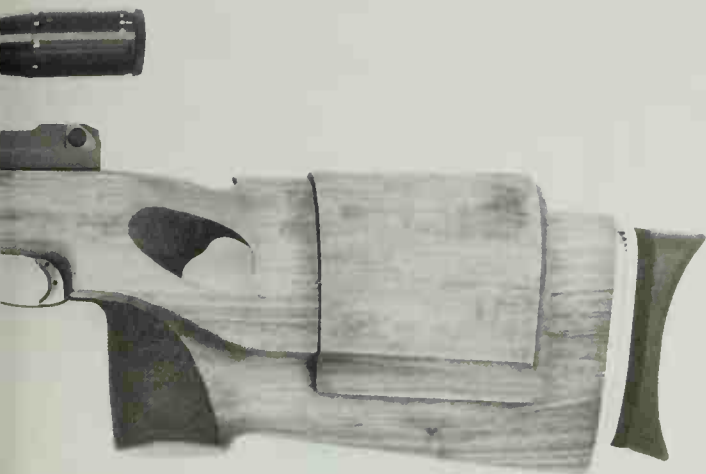
**Hilton Multi-Purpose Riot Gun (MPRG) 83**

Several different sizes and types of ammunition can be fired from this gun. It is supplied with 40/38mm, 25mm and 12-gauge bore barrels, long and short for rifle and pistol versions, which are readily interchangeable. The gun can be used with baton rounds and gas cartridges by security forces for dispersing riots. With CS smoke, signalling flares or illumination flares, the gun can be used by armed forces in combat and training, coastguards and similar organizations. Buckshot or slug round (to kill escaped dangerous animals and for similar purposes) can also be used. The gun can be used in rifle form with the long barrel and shoulder stock; if the range, velocity and accuracy of the gun in this form is not required, it can be used in pistol form with the short barrel and without the shoulder stock. The company is currently working on a 5.56mm design, which will enable the weapon to be used as a short rifle. The advantage of this sort of firearm is that it eliminates the cost of purchasing, and the necessity of carrying, several firearms to suit different calibres and types of ammunition.

**Data:** *overall length* 827.5mm (as rifle), 284mm (as pistol); *weight* 2.5kg (38mm rifle), 1.5kg (38mm pistol), 1.7kg (25mm pistol); 2.8kg (12-bore).

**Leyland and Birmingham Rubber Co. S6 Anti-Riot Respirator**

The S6 respirator protects the wearer against all known respiratory hazards, whether nuclear fall-out, biological or chemical warfare agents in the particulate, aerosol or vapour phase, or irritant smokes and gases used for riot control. The wearer is able to





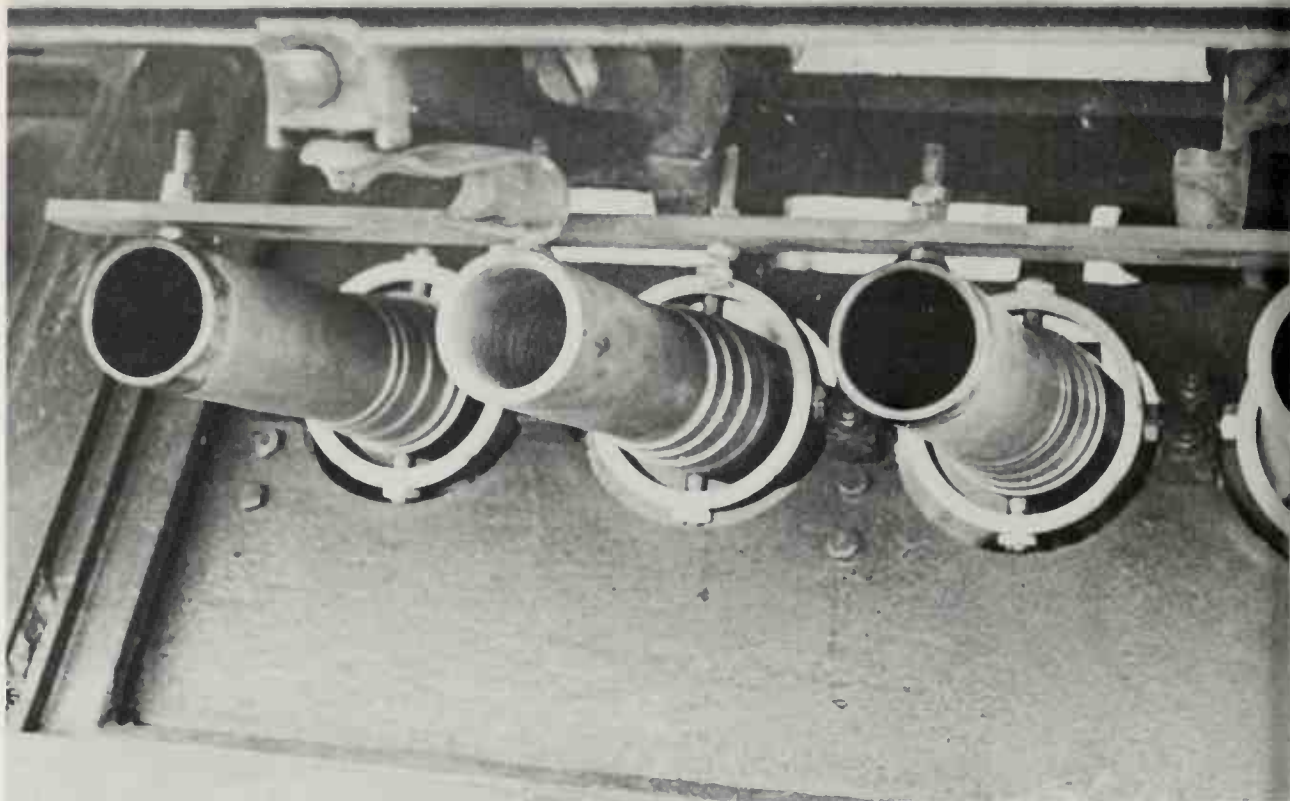


**Left:** The Israeli Projectojet lightweight CS Fog Dispenser.

**Below left:** The Hilton MPRG 83, assembled and broken down into its component parts. Also shown are some of the cartridges available for this weapon.

**Right:** The Leyland and Birmingham Rubber Company's S6 Anti-Riot Respirator, here modelled in military use. It is in service with the British armed forces and equally suited to IS operations.





**Above:** The EARP Baton Round Projector, shown here mounted in an armoured vehicle. These are fired from inside the vehicle.

operate vigorously and effectively without any risk to the face seal being broken and contamination resulting. The outstanding feature of the mask is its peripheral air cushion, which moulds itself to the contours of the face and gives considerably greater comfort and protection than many other respirators. Only three sizes are needed to suit all facial variations. The shaped eye-pieces provide a wide and undistorted field of vision and allow binoculars and other sighting instruments to be used. An air ducting system is incorporated to channel the incoming air over the eyepieces and avoid any condensation on the inside of the eyepieces. Special provision is made to enable spectacles to be worn. The resistance to breathing is very low. The integral speech transmission unit ensures that normal voice communication is possible. All components are non-magnetic and non-reflecting. The S6 is light, small, tough, durable, easily carried and rapidly fitted. It is readily decontaminated after use, and under normal storage conditions has a shelf life of 25 years.

**Employment:** British Armed Forces and several other armies.

**Data:** *weight* 0.83kg (respirator), 0.57kg (haversack and spare filter); *volume* 700cm<sup>3</sup>;

*vision* 70% without distortion or misting; *protection factor* 10<sup>5</sup> against all NBC agents.

### **MOD Anti-Riot Equipment**

**EARP Baton Round Projector:** EARP (Equipment Anti-Riot, Projector) is used by the British forces to provide barrage fire capability for 1.5in baton rounds in riot situations. Mounted in an APC, EARP consists of four pintle-mounted barrels, each of which is mated to a 1.5in signal pistol.

**Employment:** British Army.

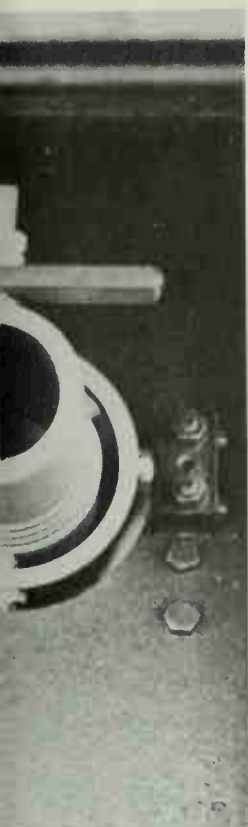
**MBSD Smoke Discharger:** The Multi-Barrel Smoke Discharger (MBSD) is a fixed four-barrel vehicle-mounted equipment used to fire the L11 A1 Bursting CS discharger and the L5 A1 smoke discharger. The co-alignment and close grouping of the barrels permit the laying down of a rapid and dense CS barrage.

**Employment:** British Army.

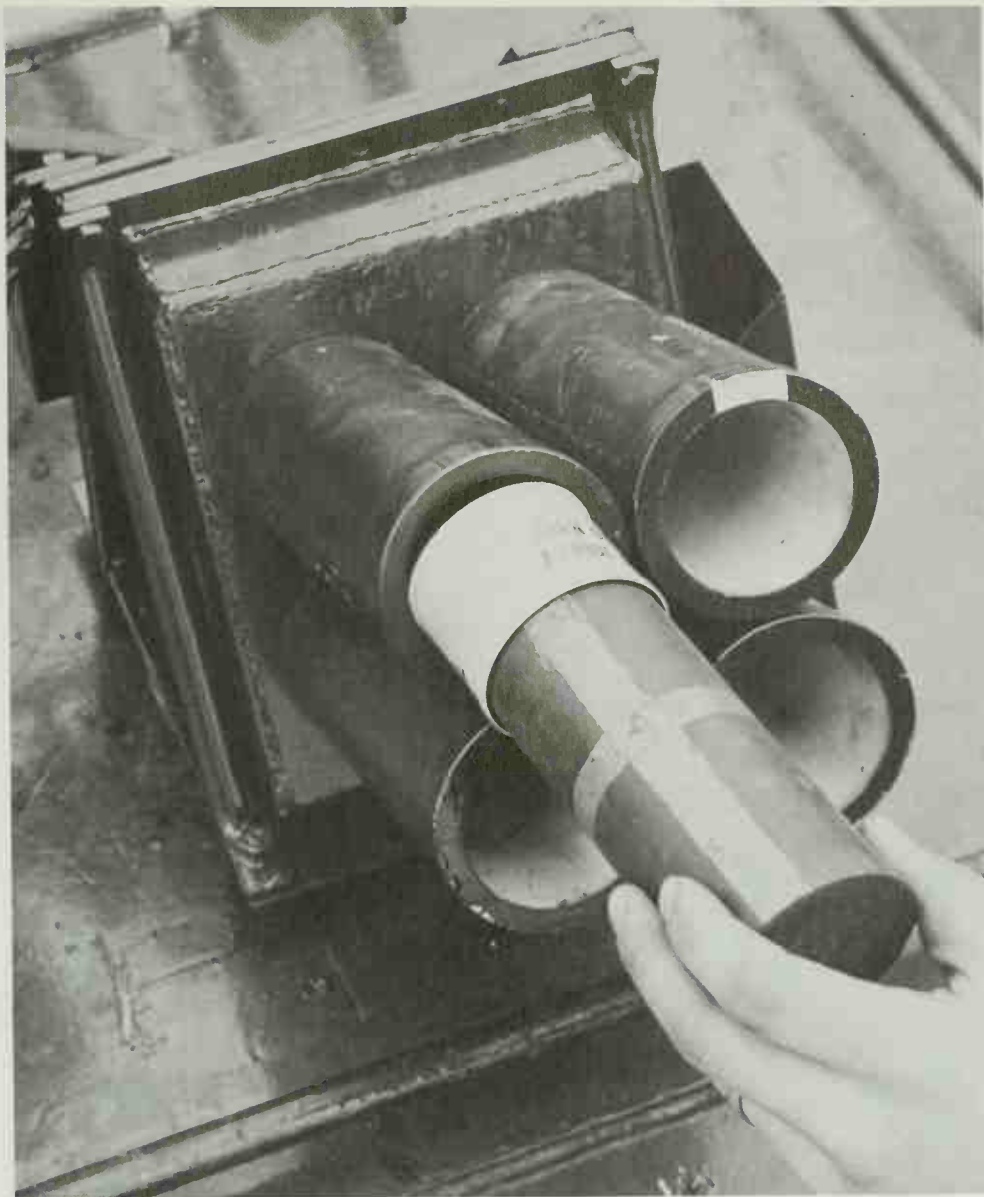
### **Royal Small Arms Factory Anti-Riot Weapons**

**RSAF Grenade Launcher:** Designed specifically as a portable launcher for the British L11 Bursting CS Grenade, the Royal Small Arms Factory (Enfield) weapon is light and easy to handle. Power is provided by two standard





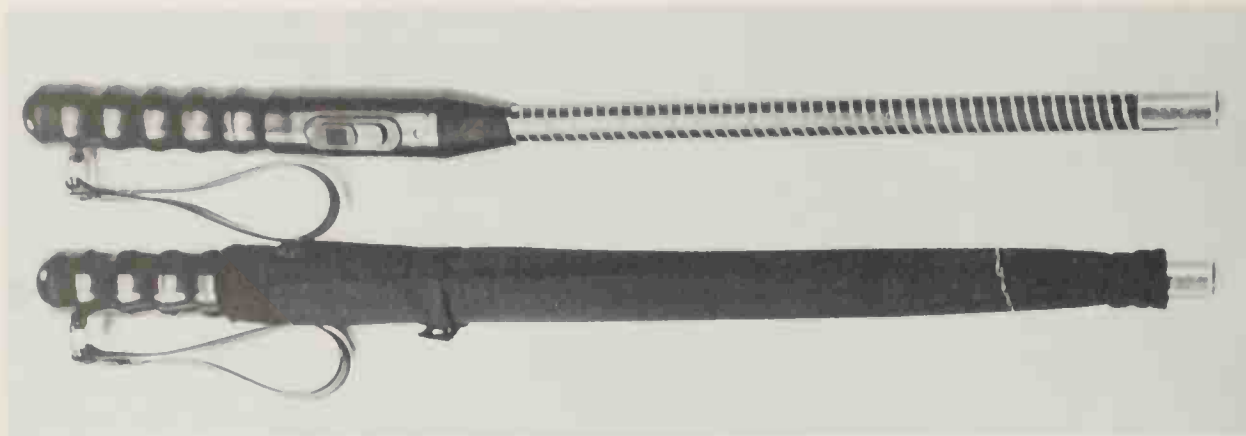
**Above right:** The MBSD Smoke Discharger shown being loaded. These have been in use for many years on British and other armoured vehicles. They are one-shot weapons which produce a fixed pattern of smoke or CS gas and are electrically fired from within the vehicle by pressing a button. When loaded with smoke grenades, they can produce an instant smokescreen, providing cover for a vehicle to extricate itself from a difficult situation.



**Below right:** The RSAF Grenade Launcher Model P100 MS. This is one of the earlier, very basic grenade launchers – nevertheless an effective weapon.







**Left:** SAS Developments's SA121 Shockstick, an interesting anti-riot weapon. This sort of equipment is not considered suitable for use in Britain, but is in service in other parts of the world including the USA.

**Below left:** The rubber bullet and baton round, shown in and out of their respective cartridges.

**Right:** The Arwen Ace anti-riot gun is a highly versatile weapon capable of firing a variety of ammunition. It was designed by the Royal Small Arms Factory at Enfield.

torch batteries, and a large number of grenades can be fired before replacement is necessary. The CS bursting grenade distributes approximately 23 smoke pellets over an area of approximately 25m diameter just before impact with the ground, providing a number of gas sources rather than a single plume.

**Employment:** British Army.

**Data:** *length* 69.5cm (overall); *weight* 2.7kg (launcher), 550g (grenade); *maximum range* 100m.

**Arwen Ace Anti-Riot Weapon:** This single-shot weapon fires the complete range of purpose-designed Arwen ammunition: AR1, which deals a non-lethal blow; AR2, which lays down a carpet of irritant smoke; AR3, which combines a body blow with a 'discreet' dose of irritant; AR4, which dispenses screening smoke; and AR5, a barricade penetrator. Loading is achieved through a single aperture, eliminating the need for a break action.

**Data:** *calibre* 37mm; *rifling* 5 groove; *weight* 2.1kg; *length* 69cm–77cm adjustable (6 positions); *rate of fire* 12 rounds per minute; *sighting* self-illuminated optical; *normal operating ranges* 20–100m (AR1), 85–95m (AR2), 2–50m (AR3), 85–95m (AR4), 2–80m (AR5).

### SAS Developments Shockstick SA121

The Shockstick, or protective staff, resembles a rolled umbrella in appearance. There, how-

ever, the resemblance ends. When switched on, it emits a powerful charge of 6,000–7,000V. However, it does not burn, or cause an injury. This is due to the very low milli-amp rating (a maximum of 8.3mA) and a wiring system localizes the shock – the recipient does not get a through-body current, and the shock is entirely confined to the small surface area that makes actual contact with the stick. It is designed to emit a loud crackling noise accompanied by blue static sparks flashing up and down the spiral element. This warns an assailant that he is confronted by something less innocuous than it appears. If he ignores this warning and grasps the stick, or is touched by it, he will be instantly repelled by the electric shock, but without suffering any harm or damage.

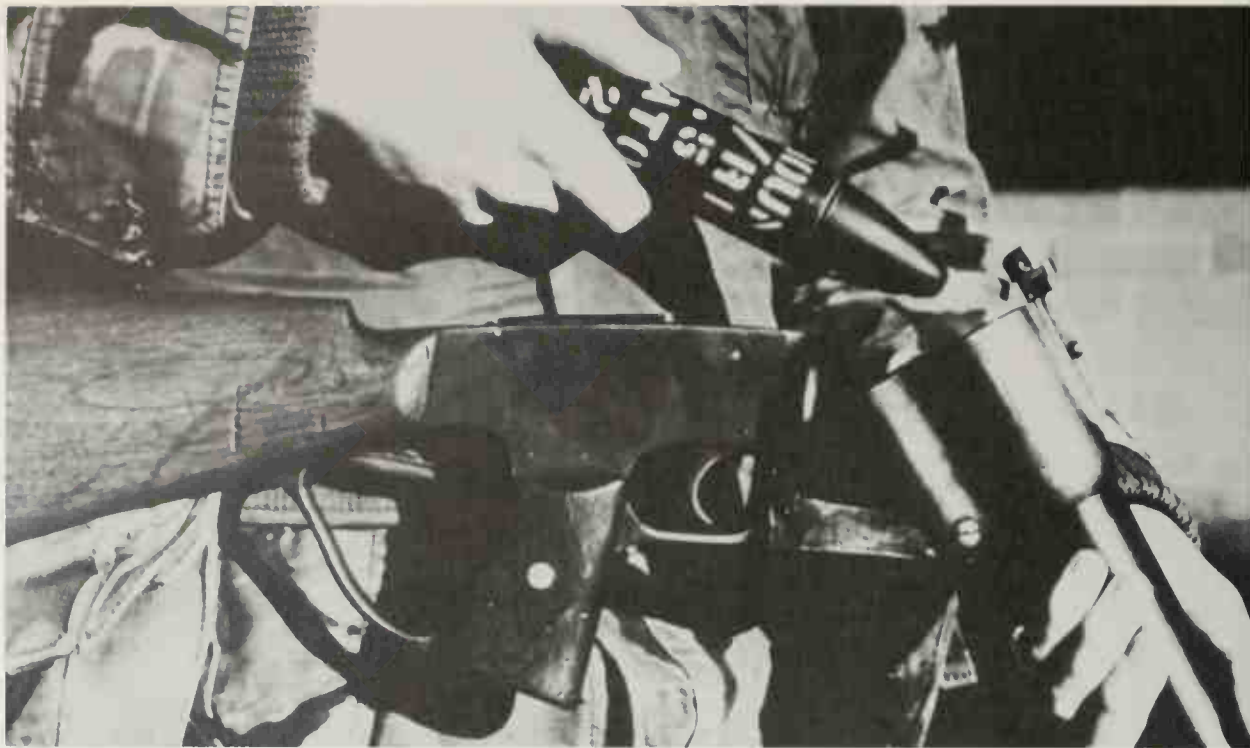
**Data:** *length* 57.8cm; *weight* 0.54kg (including batteries).

### Schermuly Anti-Riot Equipment

#### 1.5in Anti-Riot Baton and Rubber Rounds:

The round was developed to deter individual petrol bombers or stone-throwing rioters at ranges of up to 60m. When used at the recommended ranges from a chambered weapon such as the Webley-Schermuly Anti-Riot Gun, a direct shot and not a ricochet is recommended to ensure selectivity and accuracy. Severe shock and bruising are then the maximum injuries likely to be sustained. The 38mm Anti-Riot Rubber Baton Round has





**Above:** A close-up of a so-called rubber bullet being loaded into an early model British Army riot gun, showing the simple shotgun-type break action.

**Above right:** The Schermuly 1.5in Anti-Riot Gun and Signal pistol. Note the communality of parts.

**Below right:** Schermuly 1.5in Anti-Riot Irritant Cartridges L3A1.

been designed as a cheaper alternative to the L3A1/L5A2 Plastic Baton Rounds supplied to the British MOD. The rubber round (bullet) equates in performance with the plastic rounds, and, although designed specifically for use with the Webley-Schermuly multi-purpose gun, it can be fired from any 38mm riot gun or pistol. The round consists of a hardened rubber cylindrical projectile sealed in an aluminium cartridge case to make it waterproof.

**Employment:** British Army, Royal Ulster Constabulary.

**Data:** *length* 12cm (round), 10.1cm (projectile); *diameter of projectile* 3.7cm; *weight* 135g (projectile), 170g (round complete); *muzzle velocity* 100m/second; *range* 60m.

**1.5in Anti-Riot Gun and Signal Pistol:** This Webley-Schermuly lightweight smooth bore gun is a purpose-designed high-quality weapon incorporating experience and techniques gained in service. It is constructed to give optimum performance with the variety of 38mm anti-riot cartridges and rounds now in service with, or under development for, the British Army. These include baton rounds and irritant cartridges. A major advantage of this gun is that the barrel is chambered to improve muzzle velocity and to give greater accuracy compared with other unchambered guns. It is built principally of high tensile

aluminium alloy, giving excellent durability, and is a highly developed conventional single-shot, break-open weapon. The firing mechanism is of the double action type requiring a firm, long trigger pull, and the striker has an automatic rebound to avoid accidental discharge when it is closing. The design also incorporates a safety interlock to ensure that the muzzle catch is fully engaged before the weapon can be fired. Although principally used as a shoulder-fired weapon, the gun can be used from a fixed mounting on armoured vehicles. The Signal Pistol uses the same basic components as the gun, but with the exclusion of the butt, and use of a shorter barrel. The pistol, primarily used to fire smoke cartridges and signal flares, can also be used to fire baton rounds at closer ranges than the gun.

**Employment:** British Army, Royal Ulster Constabulary.

**Data:** *length* 82.8cm (gun), 25.4cm (pistol); *weight* 3.18kg (gun), 1.14kg (pistol); *effective range* 120m (gun, 38cm CS cartridge), 75m (pistol).

**1.5in Anti-Riot Irritant Cartridge L3A1:** The L3A1 irritant round carries a payload of CS smoke-producing composition and can be fired from standard 1.5in pistols and riot guns. An aluminium canister projectile holds the CS smoke-producing composition and delay unit. This canister is contained within an aluminium



cartridge case, which incorporates the percussion cap in the base and a propellant charge. For shorter ranges, an alternative round, having a reduced propellant charge, is available. When fired, a delay composition is ignited by the propellant, and emission of CS smoke begins a few seconds after firing.

**Variants:** A 'confusion round' of a rather different nature, being akin to a long-range thunderflash, is also available. This 75m-range non-fragmenting round is used to produce a brilliant flash and report in the centre of a crowd, leading to its dispersal. It is based on the same principle as the stun grenade.

**Employment:** United Kingdom (Army), RUC.

**Data:** length 12cm; weight 200g; range 100m; delay time 1.5 seconds; burning time 10–25 seconds; muzzle velocity 100m/second.

**CS Grenade Model L1A3:** Developed to provide a dense cloud of CS smoke for crowd control and dispersal, this grenade has a reinforced baseplate enabling it to be launched from suitable rifle and AFV dischargers if required.

**Employment:** British Army.

**Data:** length 14cm; diameter 6.4cm; weight 454g; effective range 30m; burning time 10–40 seconds; delay 1–5 seconds.

**Lightweight Respirator S/61:** The Schermuly S/61 protective respirator differs from most





respirators in that the filter is situated to the left side of the face where it is least in the way and allows the wearer a clear field of vision, particularly when using an anti-riot gun. An inner mask prevents the vision glass misting over. The S/61 weighs 575g.

**Mini CS Grenade:** The compact weight and size of the mini grenade give it several advantages over the L1A3 Grenade. The top cap of the grenade is unscrewed to expose the ignition ring, which is unfolded and pulled vertically away from the grenade body, thus cocking and firing the grenade in one movement. The grenade is thrown immediately, and in 1.5–3 seconds a plug is ejected and CS smoke is emitted.

**Data:** length 9.2cm; diameter 5.4cm; weight 185g; effective range 50–60m; burning time 5–15 seconds; delay 1.5–3 seconds.

**SPAD CR Aerosol:** Currently CR in a water-based solution is the active element in the Self Protection Aid Device (SPAD) hand-held aerosol manufactured by Schermuly and supplied to British armed services. The chemical may also be supplied in pre-packed and measured quantities for use with water-cannon equipment to dispel riot crowds. CR in this form is not a gas but a chemical additive, so there is no possibility of contami-

**Top left:** The Schermuly CS Grenade L1A3 shown here in its waterproof container. Note also the individual container is opened in the same manner as a sardine tin; this ensures as near as possible to ideal storage conditions.

**Left:** Schermuly's Lightweight Respirator S61, typical of the more basic respirators; though simple, it is effective, and eminently suitable for police work.

**Below left:** The Schermuly CS Mini Grenade, the outer can of which is opened like a soft-drinks can. Note that the grenade is activated by unscrewing the top of the grenade itself, which exposes the trigger mechanism.

**Right:** Schermuly's SPAD Aerosol.



nation of neighbouring buildings if it is used in urban areas.

**Employment:** British Army.

**Data:** length 11.4cm; diameter 3cm; weight 93.39g; effective range 4m.

### Security Equipment Supplies Anti-Riot Equipment

**Anti-Riot Shields:** Two models are available, made from transparent polycarbonate sheet to offer protection against hand-thrown objects and certain shotgun cartridges.

**Data:** dimensions 1655mm × 600mm × 4mm (Full Body Shield), 900mm × 600mm × 3mm (Snatch Squad Shield); weight 6.4kg (Full Body Shield), 1.8kg (Snatch Squad Shield); trauma section 25mm soft cushion (Full Body Shield), 15mm Plastazote (Snatch Squad Shield).

**Riot Helmet SES ARH 84:** Manufactured from moulded polycarbonate, this helmet is lined with brushed nylon and is fitted with a 3mm visor, which withstands the impact of a 6.5mm steel ball travelling at a velocity of 119 metres per second. On each side of the helmet are hearing apertures, and a protective neck guard is fitted. Total weight is 1.4kg.

**Respirator Model NR 82:** Giving protection against CS gas, this soft, flexible rubber

respirator is fitted with twin polycarbonate lenses retained by anodized aluminium frames. A speech diaphragm is standard and the filters afford four hours of continuous use; an inlet valve ducts air over the eyepieces to prevent misting. Weight is 0.6kg.

**Pyrotechnics:** SES also make 37/28mm Baton rounds, CS rounds, hand grenades, hand-held illuminating rockets, hand-held screening and signalling smokes, stun grenades, trip flares and Dartcord, a chevron linear explosive cutting charge contained in a lead sheath; this is intended for specialist demolitions, EOD operations and rapid access to buildings. The cutting charge cuts both metallic and non-metallic materials.

### Tannoy Waist Hailer ALS25

The ALS25 has been designed for use by personnel wearing respirators and is particularly useful for command and control during riots when CS smoke, etc., may have to be released. It consists of two parts: a loudspeaker with self-contained batteries (weight 1.8kg), which can be clipped to a web belt, and a microphone that can be stowed inside the loudspeaker assembly. The microphone clips on to the respirator on a swivel mounting, which doubles as an on/off switch. When





**Left:** The two models of Security Equipment Supplies Anti-Riot Shields. On the left is the Full Body Shield; on the right the Snatch Squad Shield.



**Above:** SES baton rounds. On the right is a three-section variant.



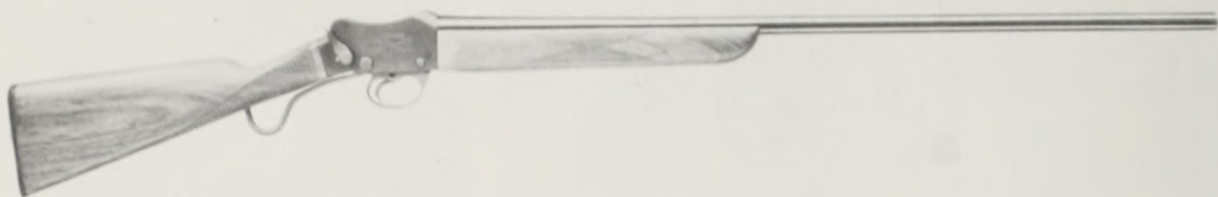
**Above right:** The SES ARH Anti-Riot Helmet, here seen with visor and neck protector.

**Above far right:** The SES NR 82 Respirator, an anti-riot respirator supplied by SES similar to the Schermuly type illustrated on page 124.

**Below right:** Pyrotechnic equipment from SES; included in this line up are baton rounds, CS rounds, hand-held and launched illuminating rockets, hand-held and projectable smoke grenades, stun grenades and trip flares.







FOR  
NON-LETHAL  
CIVIL DISTURBANCE CONTROL



STING RAG



SOFT RAG



**Left:** The Webley Greener Riot Shotgun GP Mk II, still in use in certain Third World countries.

**Centre left:** The Mossberg Riot Shotgun Model 500-ATP-6S Enforcement, a shotgun typical of many in service with US police and SWAT forces.

**Bottom left and below:** Edgewood Arsenal's Airfoil Grenade, which has two variants. Soft Rag contains a local CS gas concentration, which is released on impact; Sting Rag is a straight-forward impact projectile.

the wearer is using a radio or telephone handset, the microphone can be pivoted out of the way. Using the ALS25, clear speech can be transmitted up to 180m.  
**Employment:** British Army.

### **Webley Greener Riot Shotgun GP Mk II**

The Greener GP 12-bore was designed at the turn of the century by W. W. Greener, and is a development from the Martini-Henry rifle. Its design has remained essentially unchanged since then. In use, an underlever lowers the falling block, ejects the spent cartridge, allows a new cartridge to be pushed home, cocks the gun and puts the safety catch on – all in one action. It is a conventional shotgun and has been used by police throughout the world, mostly in the British Commonwealth, for some 35 years.

**Employment:** The Greener has been used or, in a few cases, is still in use by the British Army, South African Police, Egyptian Police, Malaysian Police, Kenyan Police, Cyprus Police, and other Commonwealth police forces.

**Data:** *calibre* 12-bore; *weights/barrels* 2.95kg/71cm, 3kg/76cm, 3.06kg/81cm, 3.12kg/86cm; *overall lengths/barrels* 113cm/71cm, 118cm/76cm, 123cm/81cm, 128cm/86cm.

## **UNITED STATES OF AMERICA**

### **Edgewood Arsenal Soft/Sting Ring Airfoil Grenades**

Soft and Sting ring airfoil grenades (RAG) have been developed by Edgewood Arsenal's weapons systems concepts office at Aberdeen Proving Ground for Army military police as a means of controlling civil disturbances without close-up confrontation. The two projectiles are fired from a launcher attached to a standard M-16 rifle. The projectile configurations are developed from a thick one-piece body of soft rubber material, shaped like an aerofoil and rolled into a ring. Both Soft and Sting projectiles have been developed to hit an individual at ranges varying from point-blank to approximately 50m, or to hit small groups at twice that distance, producing pain but with little probability of causing serious injury. Both projectiles, having the same weights and dimensions, are launched spinning at 5,000rpm, this providing gyroscopic stability during flight. A relatively flat flight brought about by this 'line-of-sight' path enables the user to aim directly and expect to hit the target. The low-drag shaping of the projectile allows it to retain a major portion of its kinetic energy during flight, thus remaining effective at long ranges. The Soft RAG is identical to Sting, except that it contains a small quantity of CS powder.

**Employment:** USA (National Guard and various Police departments).

### **Mossberg Riot Shotguns**

Mossberg & Sons of North Haven, Connecticut, have developed a line of 12-bore riot guns for law enforcement. The guns are based on the Model 500 system, except that guns are now available in either six- or eight-shot capacity. The Model 500 ATP8SP was introduced in January 1976. Barrel lengths are either 20in or 18½in and standard bead sights or rifle sights can be supplied. A bayonet lug is supplied to allow the US M-7 Bayonet to be fitted if required.

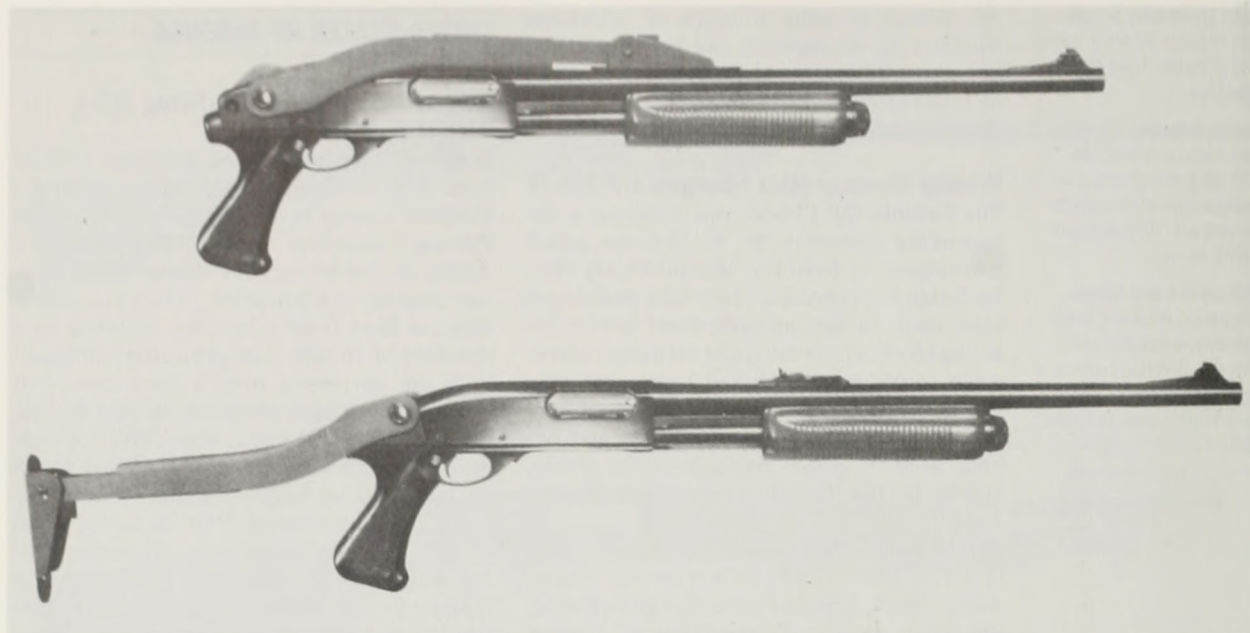
**Variants:** 500 ATP6: 6 Shot, 18½in barrel, bead sight; 500 ATP6S: 6 Shot, 18½in barrel, rifle sight; 500 ATP8: 8 Shot, 20in barrel, bead sight; 500 ATP8S: 8 Shot, 20in barrel, rifle sight.

**Employment:** Various US police forces.

### **Remington Police Gun Model 870P**

A folding stock has been developed by Remington of Bridgeport, Connecticut, for the Remington Model 870P, to meet the need







**Left:** The Remington Police Gun Model 870P, shown with the butt folded and extended.

**Below left:** A truncheon helps decorate this line up of Smith & Wesson Anti-Riot Mace dispensers. From left to right, they are Mk V, Mk III, Mk IX, Mk III Professional and Mk IV.

**Right:** The Smith & Wesson Shotgun Tear Gas Kit provides a variety of CS and CN gas grenades.

for better close-quarter handling characteristics and ease in carrying. The stock is held in the folded or extended position by an operating button that, when depressed, swings the stock to the desired position. Conventional or plastic ammunition can be used. The plastic ammunition designated Modipac, is designed as a deterrent for use at ranges of 3–15m. At ranges of 20–25m the lightweight polyethylene pellets are not able to penetrate a sheet of newspaper. However at 3–15m the ammunition has an impressive deterrent effect. Since the shells are intended as a deterrent only, they are designed for use below knee-level, and can even be bounced off the ground; plastic pellets could cause eye injuries if the weapon is fired horizontally.

**Variants:** Model 870 has a conventional stock.  
**Employment:** Police Departments throughout the US, British Army.

**Data:** *weight* 3.4kg (with 50.8cm barrel); *overall length with butt extended* 102cm (50.8cm barrel), 97cm (45.8cm barrel); *overall*

*length with butt folded* 77cm (50.8cm barrel), 72cm (45.8cm barrel); *calibre* 12-bore.

### Smith & Wesson Anti-Riot Equipment

**Chemical Mace Non-Lethal Weapons:** In 1965 these were made available to police forces in the US by Smith & Wesson. Now over 400,000 Chemical Mace Non-lethal Weapons are in service with 4,000 police departments in the US. All types are easily reloaded with a spare cartridge.

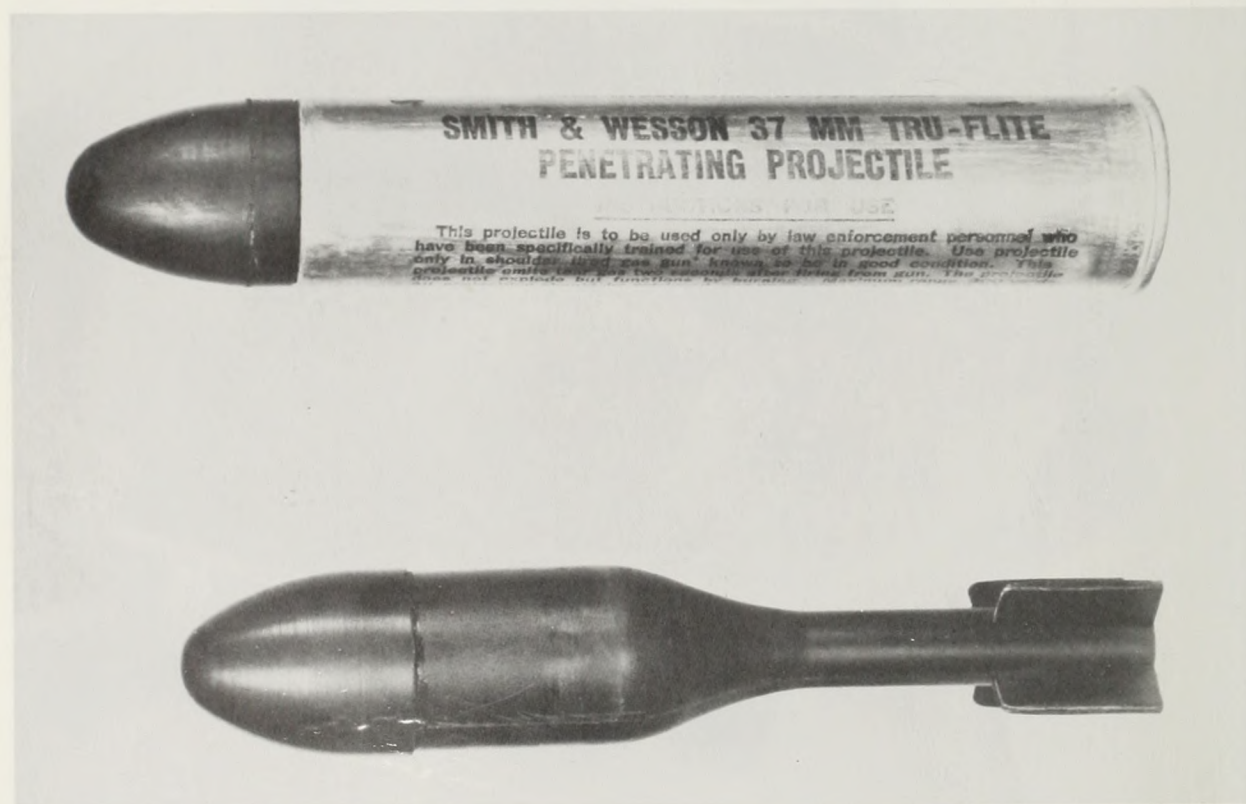
**Employment:** Various US police forces.

**Data:** *length* from 10.1cm (Mk III) to 16.5cm (Mk V); *diameter* from 23mm (Mk III) to 58mm (Mk IX); *range* (in still air) from 3–4m (Mk III) to 8m (Mk IX); *contents* from 20 (Mk III) to 60 (Mk IX) one-second bursts; *formulation* CN; *weights* from 40g (Mk III) to 300g (Mk IX).

**CN and CS Gas Grenades:** Smith & Wesson have developed a comprehensive range of grenades using both CN and CS. In particular, the Rubber Ball Grenade is worthy of special









**Top left:** The Smith & Wesson 37mm Gas and Flare Pistol.

**Below left:** The Smith & Wesson 37mm projectile, a design that emits tear gas 2 seconds after firing from a riot gun; its streamlined shape allows it to penetrate windows or doors before emitting gas; maximum range is 300m.

**Above right:** Smith & Wesson's 37mm Shoulder Gas Gun.

**Right:** Smith & Wesson Continuous Discharge Grenades Numbers 2 and 3.





mention. This innovative grenade virtually eliminates the possibility of throwback and minimizes the chance of injury.

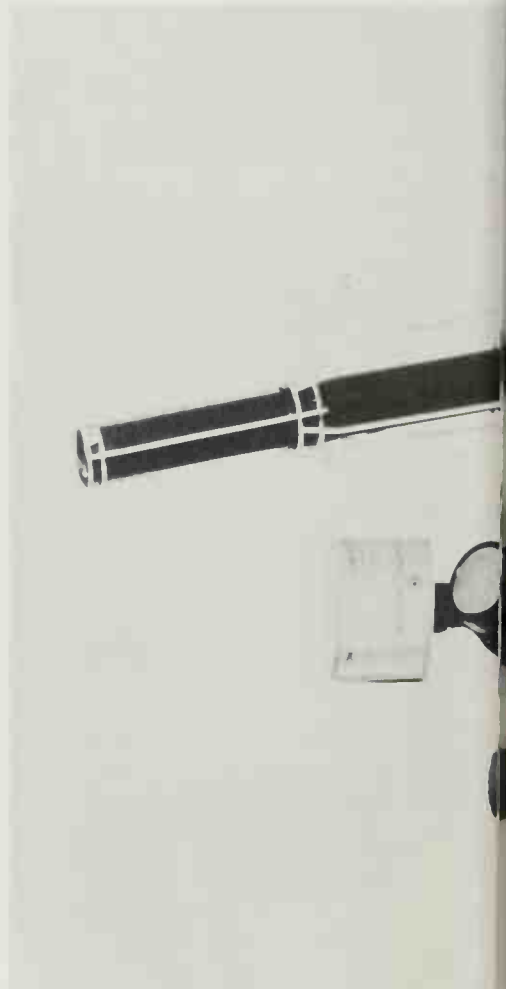
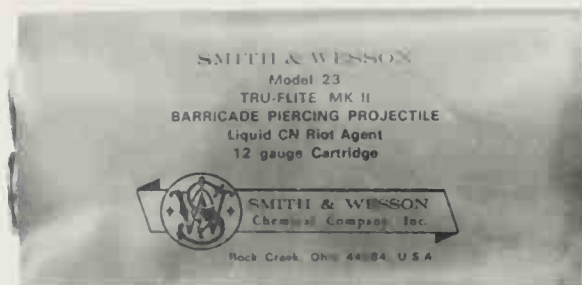
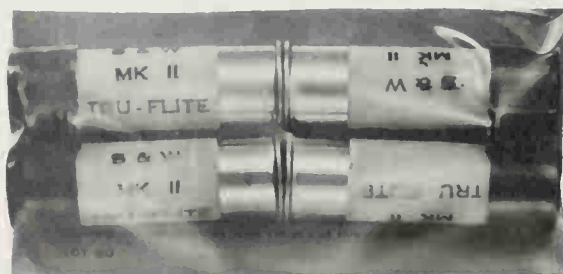
**Employment:** Various US police forces.

**Data:** *overall length* from 11.8cm (Rubber Ball No. 15) to 15.2cm (Continuous Discharge No. 2); *diameter* from 60mm (Continuous Discharge No. 3) to 84mm (Rubber Ball No. 15); *range* 30m (Mighty Midget No. 98, 50m); *burning time* between 15 and 50 seconds (Blast Dispersion No. 5 instantaneous only); *delay* 1-2 seconds (Blast Dispersion No. 5 and Mighty Midget No. 98, 3 seconds).

#### Gas Guns and Grenade Launchers.

**37mm Gas and Flare Pistol:** This pistol is designed to fire all Smith & Wesson 37mm projectiles (except for Tru-lite penetrating projectiles).

**37mm Shoulder Gas Gun:** This gun will fire all 37mm projectiles. The barrel is detachable, the weight is under 2.7kg and the length is 73.7cm.



**Left:** Smith & Wesson's Rubber Ball No. 15 Grenade.

**Below left:** Smith & Wesson Tru-Flite 12-Bore CN Projectile No. 23.

**Below:** Smith & Wesson's Pepper Fog Tear Smoke Projector pictured with some of the firm's other anti-riot weapons and equipment.

**12-Bore Launcher for Continuous Discharge Grenades:** This heavy duty launcher is designed for use on Smith & Wesson and other 12-bore police shotguns for launching continuous discharge grenades.

**12-Bore Launcher for Rubber Ball Grenades:** This launcher has been specifically designed to launch Smith & Wesson Rubber Ball grenades, and fits 12-bore shotguns. Other launchers are the 12-Bore Launching Cartridges for Mighty Midget Grenades; .38 Special Mighty Midget Grenade Launcher.

**Employment:** Various US police forces, Indian Police.

**Pepper Fog Tear Smoke Generator:** This tear smoke generator provides the effective output of thousands of cubic feet of CS and CN wherever it is required. Powered by a pulse jet engine, the unit weighs less than 8.17kg and has the fuel capacity for 45 minutes of continuous operation.

**Employment:** Various US police forces.

**Police Shotgun Model 916:** This plain barrelled 12-bore shotgun is a repeater suitable for riot situations, and is used widely by various police forces in the United States.

**CN and CS Projectiles and Shells:** These are designed to provide a stand-off capability. The 12-bore projectile will penetrate and disseminate agent vapour behind 20mm plywood at 15m or window glass at 80m. All projectiles are available with either CS or CN smoke.

**Employment:** Various Police forces in US, Indian Police.

**Data:** *length* from 6.5cm (Tru-Flite 12-bore) to 22cm (Tru-Flite 37mm); *diameter* 37mm (Tru-Flite, 12-bore); *effective range* 100m (Tru-Flite 37mm), 150m (Long Range 37mm and 37mm Rubber Projectile), 80m (Tru-Flite 12-bore) and 10m (Short Range 37mm); *burning time* from 15 to 30 seconds depending on model (Short Range 37mm and Tru-Flite 12-bore, instantaneous); *delay* 2-3 seconds







(except Short Range 37mm and Tru-Flite 12-bore, which are instantaneous).

#### Riot Control Kits.

**Shotgun Tear Gas Kit:** The addition of a chemical munitions capability makes the 12-bore shotgun a highly effective non-lethal weapons system. This Smith & Wesson shotgun Tear Gas kit contains a variety of CS or CN Tear Gas grenades, a 12-bore grenade launcher, and 20 Tru-flite Barricade projectiles.

**Mighty Midget Grenade Kit:** This is a light-weight composite kit which contains 12 Mighty Midget grenades, either CS or CN, 12 Mighty Midget .38 special launching cartridges and a universal revolver launcher to fit any .38 Special or .357 Magnum revolver. The kit, which measures 19.2cm x 29.2cm x 9cm, weighs just 2.27kg.

**Portable Riot Control Emergency Kit:** This kit weighs 13.61kg, is 84.2cm long, 35.5cm wide and 14cm deep. The kit contains a Smith & Wesson 37mm gas gun, 4 Tru-Flite 37mm



**Above left:** The Smith & Wesson Portable Riot Control Emergency Kit.

**Left:** The Mighty Midget Grenade Kit.

**Above right:** The Anti-Riot Training Kit.

penetrating projectiles, 6 long-range 37mm projectiles, 6 short-range 37mm shells and 4 continuous discharge grenades. All grenades and projectiles are available in CN or CS gas. **Riot Training Kit:** This kit is housed in the same container as the Portable Riot Control Emergency Kit, but does not contain a 37mm gas gun. Instead it contains practice continuous discharge grenades, live smoke grenades, practice 37mm long-range projectiles, a Chemical Mace aerosol, and two Chemical 'Wand' CS disseminators. There are also CS and CN capsules for training purposes, and spare grenade pins so that the practice continuous discharge grenades can be reused. In all, this kit makes an extremely useful aid for training police forces.

**Employment:** All these kits are in use with various US police forces, and are thought to have been purchased by some police forces in South America and the Far East.

### **Tecom Riot Control Agent Dispenser M33A1**

Developed in 1974 by Tecom Engineering,

this equipment is used for control of riots in outdoor areas. Its payload of 11.4 litres of 0.1% CS in a mixture of propylene glycol and water is dispersed through the gun nozzle by a compressed-air supply. A four-port rotatable nozzle on the end of the gun provides both spray and stream liquid agent capabilities up to 20m range with a discharge time of 25 seconds in either continuous or intermittent bursts. The dispenser can be readily converted to dry-powder agent use by substituting the four-part rotatable nozzle with a single-port nozzle and replacing the agent container check valve assembly with an agitator assembly. 3-4kg of CS can be dispersed up to 15m range with a discharge time of 60-120 seconds in either continuous or intermittent bursts. Modular construction permits rapid turn-round using pre-filled agent and air containers.

# Body Armour, Shields and Bomb Disposal Suits

Body Armour is normally designed to protect only the most vulnerable parts of the body, namely the chest and the back. It is not feasible to provide adequate protection for the head, except for the special case of bomb disposal, in which case every attempt is made to provide maximum protection for all parts of the body. The more comprehensive, but cumbersome, bomb disposal suits inevitably affect vision. Armour can be provided for the arms and legs, but this inevitably slows down movement.

A wide range of body armour is now on the market. It varies from lightweight concealable undervests, designed to provide protection against low-velocity ammunition fired from submachine-guns and handguns, to heavier vests designed to stop high-velocity rounds. Nowhere has the art of manufacturing bullet-proof vests reached the level of the United States, where virtually every policeman (and even some private citizens) wear them. Special vests have even been developed for women. It is due mainly to the Emergency in Northern Ireland that there are also many UK manufacturers of body armour. Other manufacturers in Belgium, Germany, Israel and Switzerland have since produced their own versions.

Conventional military helmets have proved inadequate in IS situations. They were too heavy, offered insufficient protection and, in some cases, were difficult to keep securely on the head in situations when the wearer was being jostled in a crowd, acting as a member of a 'snatch' squad, jumping in and out of vehicles or was involved in a number of demanding IS situations. Various manufacturers in the United States, the United Kingdom, Switzerland, Germany, Belgium and other Western countries, have therefore produced a range of helmets to offer a much higher degree of protection. In some cases they are constructed of high-quality Titanium metal; most have visors of some sort to provide at least protection against stones, and some provide protection against low-velocity rounds. All are much closer-fitting and secured by chinstraps; some, particularly those designed for ATOs, have built-in

microphones and earphones connected to a two-way portable radio set. Some are designed to allow the use of respirators under an armoured visor, while others permit the attachment of night vision aids to the helmet itself, thus keeping the hands free for driving a vehicle, holding a weapon or flying an aircraft. In short, IS helmets are highly sophisticated and a long way removed from the conventional infantryman's 'battle bowler'.

There are basically two types of shield: one is designed to be used in a riot situation and must therefore cope with stones, bricks and bottles; the other is proof against bullets. Most riot shields are constructed of polycarbonate and are both shatter-proof and fire resistant. The German company of Rheinstahl for instance (who make the Marder MICV), also make a variety of bullet-proof shields that incorporate pistol and vision ports. There are more cumbersome casemates for use in hijack or shoot-out situations: these are on wheels and offer complete protection against 7.62mm rounds while remaining towable and manoeuvrable by the men they are protecting. Other ingenious ideas include bullet-proof clipboards. Though only proof against handguns, such a device affords a chance of survival for a gate security man who is, for example, checking a vehicle when the occupant produces a handgun at close range and without warning in order to force an entry.

This section of the book also covers shatter-resistant film, bullet-resistant laminate, bullet-resistant glass, bomb curtains and other types of body armour. Bombs cause flying glass which can cause widespread injury. It is possible to apply a form of adhesive to glass that holds shattered glass together. Similarly, a laminate can be applied to car or house windows to withstand strikes by 7.62mm rounds from a range of 10m. Cars are in particular need of protection: violent attacks on VIP cars and security vehicles are increasing in frequency and ferocity all over the world. Here, the glass is of crucial importance. Road vehicles, especially saloons, must have adequate visibility: unprotected



**Right:** When British troops were first deployed in Northern Ireland in 1969, they had no special purpose riot equipment. One of the first measures to be taken was to attach a visor to the existing standard helmet. This proved to be uncomfortable and in other ways unsuitable; however, for many years British troops had to make do with this equipment. Over the last two decades, the protection afforded to military and police personnel in anti-riot and internal security activities has improved enormously, with the introduction of new, lightweight armour materials, such as Kevlar. Equipment and garment designers have also benefitted from the great amount of experience IS forces have gained during this time.





windows cause a VIP passenger to be highly and unnecessarily vulnerable. However, car windows can be manufactured to offer a high degree of protection against handguns, shotguns and other weapons and can be curved and framed so that, when fitted, they are visually quite indistinguishable from ordinary glass.

Very simple precautions in Government buildings, which are vulnerable to terrorist attack, can be achieved. Clearly it is not possible, except at enormous expense, to fit bullet-proof glass to every window in a large government building. A far cheaper solution is to hang anti-bomb curtains – a simple mesh curtain that is weighted at the bottom to catch any glass that is blown inwards by the force of explosion from a bomb placed outside the building. Body armour additional to helmets, shields, bullet-proof vests, 'flak' jackets and EOD suits is also available – indeed in theory there is no limit to the amount of armour that can be provided for the

soldier or policeman in a riot situation. The British have used fragmentation collars, abdominal protectors and leg protectors in Northern Ireland. Another options is so called 'variable' body armour: this is basically a light protective jacket with large pockets at the front and rear into which heavy metal plates are inserted according to the degree of protection required. Weight considerations make it likely that such equipment would be more usually worn by vehicle-borne troops or those deployed in a semi-static role, such as manning a check point.

In general, there is a limit to the amount of protection that can be realistically achieved for a soldier or policeman who is expected to be mobile, agile and able to react to a variety of situations. In the final analysis, it is not possible to guarantee immunity from a high-velocity rifle in competent hands. But it is possible to provide complete protection against many threats and to increase the overall chance of survival against most others.



Below, from left to right: FN's Bullet-Proof Vests P100, P200 and P400. These are late 1970s vintage but still in use in Belgium.

## BELGIUM

### Fabrique Nationale Protective Garments and Equipment

**Bullet-Proof Vests P100 and P200:** FN favour a type of bullet-proof vest made with synthetic material and fitted with steel plates, which suffer only a slight deformation at the moment of impact.

**Variants:** P400. No specification is available.

**Employment:** Belgian and other police forces.

**Data, P100:** *weight*, with 2mm thick armour plate 4.2kg; with 2.5mm thick armour plate 5.1kg; with 3mm thick armour plate 6kg.

**Data, P200:** *weight*, with 2mm thick armour plate 6.5kg; with 3mm thick armour plate 10kg.

**Bullet-Resistant Shields B500 and P400:** These shields are designed to withstand a strike by a 7.62mm round. The B500 is curved and can also be used for long periods by deploying the legs on the bottom of the shield. The P400 is a

more conventional shield of flat, square design. Both are designed for use in shoot-out situations as protection against small-arms fire rather than in riot situations, for which they would be too heavy.

**Employment:** Belgian police.

**Data, B500:** *thickness* 2mm (weight 7kg), or 3mm (weight 10.3kg).

**Data, P400:** *height* 60cm; *width* 50cm; *thickness* 2.5mm; *weight* 8kg.

**Casemates P700 and P800:** FN have developed the P700 (*thickness* 6.5mm, *weight* 370kg) and P800 (*thickness* 6.5mm, *weight* 590kg) Casemates for use in hijack or shoot-out situations. Both versions offer complete protection against NATO 7.62mm rounds. They are towable and have axle brakes, and in operation they are manoeuvrable by the man or men they are protecting. They can, of course, also be used to approach an IED in order to inspect it.

**Employment:** Belgian police.

**Data, P700:** *thickness* 6.5mm; *weight* 370kg.

**Data, P800:** *thickness* 6.5mm; *weight* 590kg.

**Cromwell Helmet:** The FN Cromwell Helmet is constructed of reinforced polyester, fully lined with aired foam and set in a shock-proof rim. The helmet has an adjustable chinpiece and a visor made from shockproof plexiglass 5mm thick. The FN gas mask can be worn with the helmet.

**Employment:** Belgian Police.

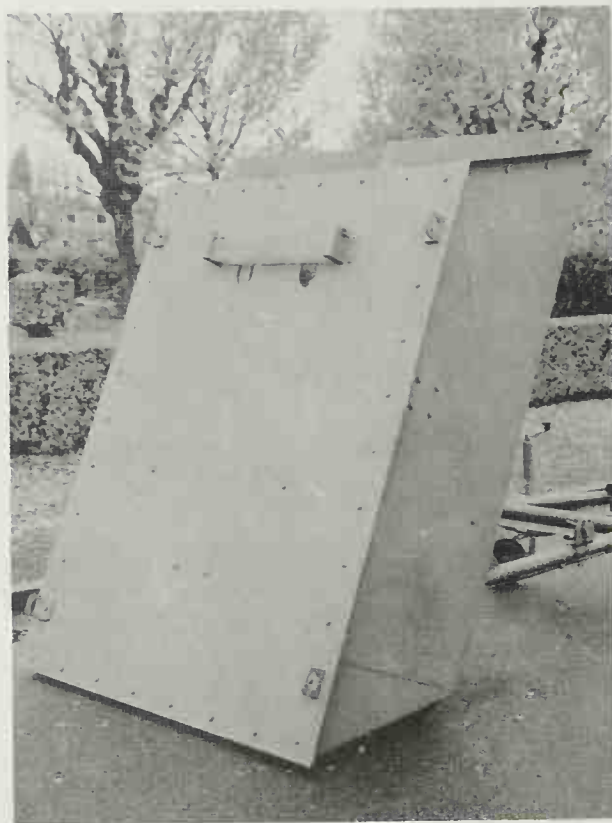
**Riot Shield B10:** The weight of this is 3.2kg. It is proof against all types of missiles likely to be encountered in a riot situation. The circular variant is slightly lighter.

**Employment:** Belgian police.

### Glaverbel-Mécaniver VHR Glass

Laminated high-resistance glass, as developed by Glaverbel-Mécaniver of Brussels, consists of two or more sheets of drawn or float glass. This combination offers a high mechanical and thermo-mechanical resistance, and is assembled with an interlayer of plastic known as polyvinyl butyral. The thickness of the glass must be appropriate to the type of arms and calibres against which protection is required and to the number of shots the glass is expected to have to withstand. When the appropriate thickness of glass is provided, tests have shown that VHR glass can prevent penetration of bullets. Tests with VHR glass in Sweden in 1975 showed that one 7.62mm round from a rifle fired from five metres at 35mm thickness VHR glass did not achieve penetration, although there was a degree of spalling. Lower velocity weapons achieved no penetration and caused no spalling.







**Left:** FN Casemates P700 (top) and P800 (below). Several manufacturers make casemates, but FN perhaps make a more comprehensive range than most.

**Below:** The FN Cromwell Helmet. This is typical of many of the earlier versions in which converted crash helmets simply had a perspex visor added.

**Below centre right:** FN Riot Shield.

**Below far right:** The Hagar Armour Vest, which has seen valuable service over many years with Israel's armed forces in conventional and internal security situations in urban Israel.

**Employment:** Glaverbel VHR Glass is used in various high-risk buildings in The Netherlands, Switzerland, Sweden and Belgium, and by police on armoured cars in The Netherlands.

## GERMAN FEDERAL REPUBLIC

### Berka IWKA Armoured Vests

Made of synthetic textile fibre, IWKA vests are extremely light. All models allow for the insertion of steel plates. Exhaustive tests carried out in Germany have shown that a high degree of protection is afforded: for example an MP5 9mm was not able to penetrate the vest from 10m. The result was a dent diameter 10mm and maximum depth 1mm.

**Employment:** German Border Police, police forces of several German states, several Swiss Cantonal police forces, and some German and foreign banks.

**Data:** *weight with steel plate* 6.3g (Model A), 7kg (Model B); *weight of groin protector* 2.5kg (with steel plate); *weight of Model C* 9kg (front steel plate 2.5kg, rear steel plate 3.5kg).

## ISRAEL

### Hagor Armour Vest

The Hagor Armour Vest is constructed of Kevlar, five times stronger by weight than steel. The outer shell consists of two layers of ballistic nylon. The vest is designed to give

protection against an Uzi sub machine-gun fired from a distance of 10m.

**Employment:** Israeli Armed Forces.

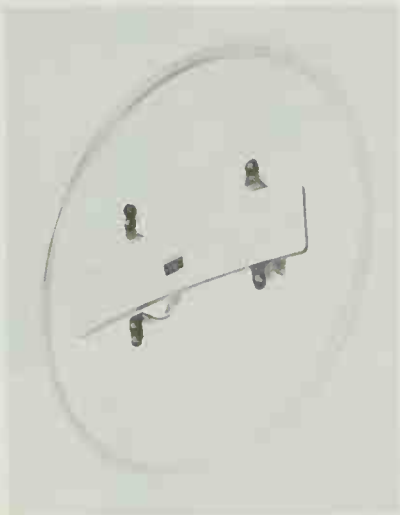
## SWITZERLAND

### Tig Bicord Protective Garments and Equipment

**Bomb Disposal Suit:** Consisting of a protective helmet with wide-angle visor, front section, back protector panel and leg and foot protectors, this bomb disposal suit is made of extremely resistant material, which largely eliminates potential injuries while permitting good mobility. The front section incorporates an additional two-section metal armour plate of special ballistic material designed to deflect the shock wave in case the bomb explodes. The high collar provides protection against neck injuries, while the back section has a pocket for a radio transeiver and bomb disposal tools. The titanium safety helmet can be equipped with earphones and a microphone so that contact with the EOD specialist can be maintained.

**Safety Helmet PSH-77:** Made of titanium, PSH-77 comes in one size, with interior adjustment. It offers protection against bomb and grenade splinters and claims proof against 9mm Uzi submachine-gun rounds.

**Variants:** Visor VS-K-77 incorporates a wide-angled eye guard; visor VS-K-NV carries night vision equipment NV-2; a 12mm-thick transparent visor is also available, and this can be locked in raised or lowered positions. Facilities are inbuilt for the helmet to take headphones and a microphone.







Tig Bicord protective equipment.

**Far left:** Bomb Disposal Suit.

**Left:** Safety helmet PSH-77.

Top, the basic helmet, visibly demonstrating its effectiveness against 9mm rounds; centre, the military version with chin strap; bottom, the matching titanium 'visier' VS-K-77, which is also claimed to keep out 9mm Uzi rounds.

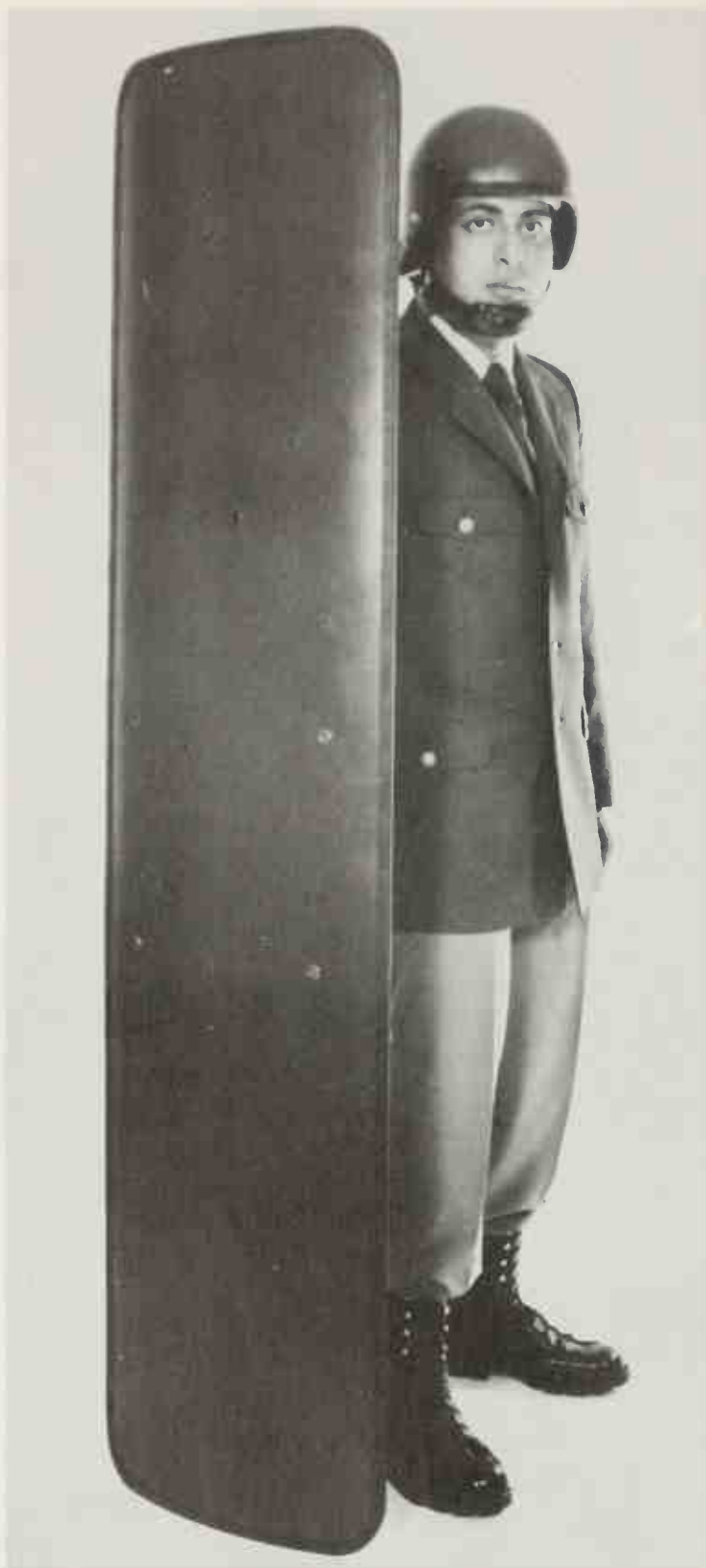


**Above:** Night vision equipment NV-2 mounted in visor VS-K-NV. This offers complete protection to the face, and the outer shell of the helmet can be manufactured of material that absorbs infra-red rays.

**Left:** The gas mask can also be worn beneath the helmet.

Tig Bicord are confident enough to offer a ten-year guarantee with their helmets.





## UNITED KINGDOM

### Armourshield Protective Garments and Equipment

Armourshield Ltd of Manchester produce a range of body armour, screens and shields, structural protection for buildings and protection for vehicles and aircraft. The Company has introduced the patented 'Blunt Trauma Shield' which is incorporated in all their body armour. Armourshield products are currently in use by 40 British police forces, British and Commonwealth armies and the Royal Navy. The FW 25 TF Body Armour has 40,000 units in worldwide operational use.

**Armoured Clip-Board:** Handily inconspicuous as a normal clip-board, this lightweight (1.4kg) item affords a 38cm × 25.5cm protective area and claims to stop 9mm × 19mm British Mk 2Z, .375mm and .44 Magnum JSP fired from a 25.5cm barrel Thompson/Contender at 3m.

**Body Armour:** Armourshield supply a variety of garments, all with the built-in 'Blunt Trauma Shield' protection, including Model 777/25 wrap-round upper body soft armour, which has the ability to stop a .44 Magnum from a 10in barrel from 3 metres; with ceramic plate this can be upgraded to stop 7.62mm high-velocity rifle rounds.

**Variants:** Model 777/UL is concealable soft wrap-round upper body armour; FW25, which is covered in fire-resistant, water-repellant



**Far left:** Tig Bicord's full length body shield.

**Above left:** Modern body armour sufficient to stop low-velocity rounds can easily be worn inconspicuously; beneath normal clothing is Armourshield's Model 777 Concealable Armour.

**Above right:** Many manufacturers offer armoured clip-boards, which can function as a very discreet form of ballistic protection. This is Armourshield's.

cotton, has extra side wrap-over; Model 555/25 and 555/UL are soft armour garments without side protection; FW20.G has extra side wrap-over plus a drop-down groin protector. FW20 and FW25 can be fitted with extra protective zones including shoulders, side and neck protection, extra under-arm covering and a rear seat protector. Fragmentation Cape 25 is a lightweight bomb suit with side ventilation permitting the garment to be worn with comfort for long periods. UV/14 is the latest in the range, a concealable ultralight undervest with front and rear protection.

**Employment:** Model 777/25 has been sold in the United Kingdom to the Army and police forces, also to the US Federal Forces and police in 1986. Fragmentation Cape 25 is in operational use with London's Metropolitan Police Bomb Squad.

**Data:** *weights*, Model 777/25 2.26kg, FW25 2.72kg, UV/14 1.13kg; *stopping capability* of FW25 5.56mm ball M-16 and Armalite, 7.62mm ball Kalashnikov, NATO and Soviet

Ball (sniper) at 5 metres; uparmouring is possible to improve stopping capability; other attributes include infra-red signature protection (777/FL17).

**Ballistic Protective Shields and Screens:** Armourshield makes a hand-held shield for use in confined spaces, where the user has no alternative but to enter through a window or door. This shield will fit most aircraft windows and doors. Two self-supporting screens are also available for use in surveillance operations, etc. The Lightweight Flexible Screen is of soft material mounted on a portable frame; a Rigid Portable High Velocity Screen affords enhanced protection from armour-piercing high-velocity rifle fire and consists of two separate screens on a steel frame.

**Employment:** In operational use by major government departments worldwide.

**Data:** *dimensions* 60cm × 48cm (Shield), 2m × 1m (Lightweight Flexible), 2m × 1.25m (Rigid); *weights* 4.98kg (Shield), 6.80kg (Lightweight Flexible); *stopping power* short bursts from British 9mm submachine-gun (Shield), 7.62mm Kalashnikov armour-piercing round at 3m (Rigid).

## Bristol Composite Materials Armoured Garments and Equipment

**Bristol Armour:** Bristol Armour is formed from a fibre reinforced plastics composite to provide protection at varying levels (Grade 25-Grade 86) against low-velocity weapons. A hard-faced armour made of ceramic reinforced plastics is available to provide protection against armour-piercing and high-velocity bullets.

**Data:** **Grade 25** (max. weight 5.31kg, front, back and pelvic) is designed to stop 9mm ammunition fired from Sterling L2A3 submachine-gun at 23m. **Grade 30** (max. weight 5.46kg, front, back and pelvic) is designed to stop 9mm parabellum ammunition fired from Browning automatic pistol at point-blank range. **Grade 36** (max. weight 7.41kg, front, back and pelvic) is designed to stop .44 Magnum ammunition fired from 4in barrel revolver at 2.7m. **Grade 50** (max. weight 10.11kg, front, back and pelvic) is designed to stop .30 calibre ammunition fired from US M1 carbine at 32m. **Grade 64** (max. weight 13.80kg, front back and pelvic) is designed to stop 9mm armour-piercing steel cased ammunition fired from standard submachine-guns at 5m. **Grade 86** (max. weight 11.41kg, front and back only) is a hard-faced armour designed to stop 7.62mm ball ammunition fired from FN FAL rifle at 91m.





Armourshield protective garments and equipment.

**Top left:** Model BG777 Concealable Undershirt Vest, ultra-soft body armour.

**Left:** Upper Body Wrap-Round Vest FW 25 TF in camouflage format with capacity for front and back ceramic plate inserts; more than 40,000 of these vests are in service around the world.

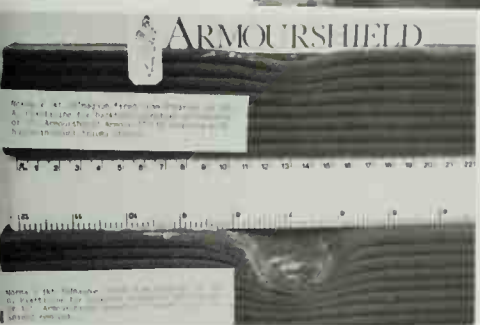
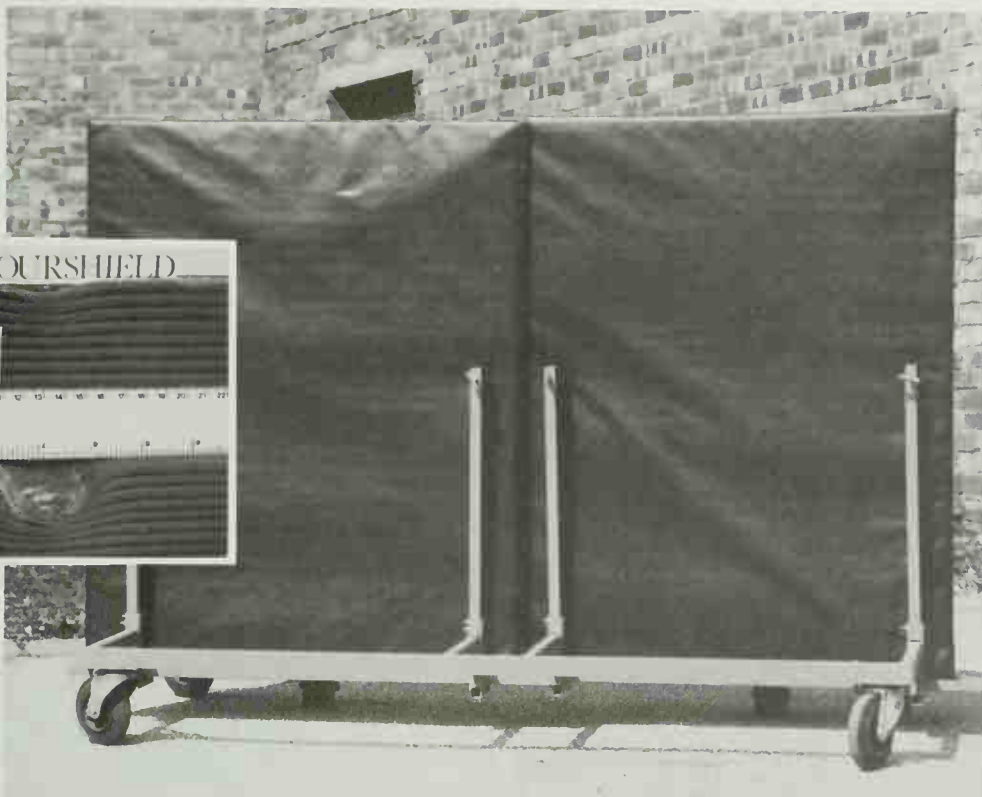
**Below far left:** FW20 upper body full wrap-round vest with groin protector.

**Below left:** Fragmentation Cape 25.

**Right:** Ballistic Protective Shield Type BPS/A. Note that the rear of the shield at the grip is covered with Armourshield's Blunt Trauma Shield material, in order to protect the arm against the shock of bullet strikes on the face of the shield.

**Below:** Demonstration of Armourshield's Blunt Trauma Shield, here shown in plasticine. The 'back face signature', the effect of the shock from a bullet strike, is dramatically reduced when the shield is in place (upper photo).

**Right:** The Rigid High Velocity Screen.





**Left:** The Bristol Composite Materials Armoured Clip-Board, demonstrating the sort of situation in which such a piece of equipment is expected to perform.

**Below left:** Bristol Transparent Armour proves its stopping power.

**Below:** Bristol concealed armour, designed to be worn under clothing, easily concealable while yet providing basic protection against low-velocity rounds.

**Below right:** The police version of the Bristol Hard Armour Suit.

**Type 10:** This garment has been designed to be worn unobtrusively under a jacket so that it is suitable for use by VIPs and plain clothes police. Normally suited to armour grade K8DS, the Type 10 can be provided with grade K16DS if required, although this will be heavier. Ceramic armour and traumatic attenuation plates can be inserted.

**Type 12:** This forms the basis of the new protection system devised by Bristol for search teams. It provides 360° ballistic protection against low-velocity rounds and, with the insertion of a ceramic plate, against high-velocity rounds.

**Armoured Clip-Board:** The Armoured Clip-board is designed to give ballistic protection against handguns at vehicle check points.

**Concealed Armour:** The armour consists of a basic Kevlar composite jacket weighing 1.55kg. It is claimed that the vest stops .22, .38 Special, 357 Magnum, 9mm handguns and No. 5 shot from 12-bore shotguns.

**Flexible Armour:** This is designed for over-uniform wear and consists of a Kevlar composite jacket covering front, back and sides. Ceramic plates can be added to increase protection. The standard jacket weighs 3.9kg and

the ceramic panels weigh 1.1kg, 2.2kg or 3.0kg each, depending upon the level of protection afforded. The panels increase the protection to the level of 7.62 ammunition.

**Bomb Disposal Suit:** Bristol manufacture a suit weighing 28kg. A third generation suit is now under development.

**Hard Armour Suit:** Bristol have developed the Hard Armour Suit for wear by police or troops. The suit provides protection against NATO 7.62mm rounds, and consists of rear, front and front lower hard-armour plates. It is particularly suitable for static tasks such as road-blocks, guarding vulnerable points, or for wear in a shoot-out.

**Lightweight Helmet:** This helmet is constructed in two grades of composites to give differing levels of protection. The Grade 9 helmet stops a 158 grain lead bullet fired from a Smith & Wesson .38 Special revolver at 5m at 260m/second. The Grade 17 stops 17 grain fragments at 420m/second. The Grade 9 weighs 0.75kg; the Grade 17 1.25kg.

**Transparent Armour:** For use in military vehicles, and designed to stop low-velocity ammunition, Bristol Transparent Armour weighs 43kg/m<sup>2</sup> at a thickness of 28mm.







### **Carleton Russell Armadillo Bullet-Resistant Laminate**

A lightweight, opaque, bullet-resistant laminate, Armadillo is manufactured in layers of material, each layer being approximately 0.63mm thick, and is built up in standard increments of five layers to a maximum of 60 layers. Only 9.45mm thickness Armadillo is required to resist three strikes by a 9mm handgun from a range of 3m, whereas 38mm thickness is required to withstand three strikes by a 7.62mm rifle from a range of 10m. Armadillo can be used for office or shop windows and police or VIP car windows.

**Employment:** Netherlands, United Kingdom.

### **Gault Glass Laminates EOD Suit Mk 2**

Since trials with the British Army in 1974, the Gault Glass Laminates EOD Suit Mk 2 has entered production and further details have been made available. The suit, which weighs 19.2kg, comprises flexible-armour trousers and foot extensions, flexible-armour jacket with high collar and back apron with two tool pockets in the skirt. To the front of the jacket is appended a rigid armour breastplate, with integral deflector to direct blast away from the face, and a rigid pelvic plate. Worn with the suit is a special heavyweight EOD helmet with armoured visor, developed by Amplivox. (See also MOD Body Armour).

**Employment:** 35 countries including United Kingdom.

**Weights:** *Jacket* 7.2kg; *trousers* 3.8kg; *back apron* 3.6kg; *breast and pelvic plates* 4.6kg.

### **Helmets Ltd. Cromwell Argus Protective Headgear**

Helmets Ltd. of St Albans, produce the Cromwell Argus range of helmets, which are in extensive use with police forces throughout the UK. The Argus comes in several versions. It is constructed from a lightweight glass-fibre and polyester resin lamination with an energy absorbing liner. The visor is made from 3mm shatterproof polycarbonate and is capable of withstanding the impact of a 6.5mm steel ball travelling at a velocity of 119m/second without fracture or significant deformation. Argus has hearing apparatus and a 'neck curtain' for additional protection.

**Employment:** Anti-riot helmets have been in use with the British Army for a considerable period.

**Data:** 4 head sizes are available; *weight* 1.4kg (average); *protection* to 16.59kgf with less than 19.6kN.

**Left:** Lightweight Body Armour's EOD Suit.

**Top right:** The Cromwell Argus SP5 Helmet with Neck Curtain PNC1 and 3mm polycarbonate Visor SPV2. This version has injection-moulded thermoplastic and gauze hearing apertures.

**Top far right:** The 9mm-ammunition-proof APH6 helmet from Lightweight Body Armour.

**Below right:** Lightweight Body Armour's large Armoured Clip-Board.

**Below far right:** The Lightweight Body Armour Siege Shield, here seen in its folded configuration; it can be extended to full body height.



### Lightweight Body Armour Garments and Equipment

All products use the Tetranike armour system consisting of resistive laminated materials. Products range from protective vests, EOD suits, helmets and shields to composite armour materials for vehicles, boats, aircraft and equipment.

**Armoured Clip-Board:** An ordinary clip-board that doubles as a mini-shield. A rigid handle is fitted to the back.

**Data:** *weight* 1.2kg; *dimensions* 385mm × 310mm.

**Helmets:** Model APH4 provides protection

from shell fragments; APH6 defeats up to 9mm NATO ammunition, as does the Police Helmet PPH. Various chinstraps can be fitted, as well as visors, neck guards and camouflage nets.

**Weights:** APH4 1kg; APH6 1.4kg; PPH 1.4kg; standard visor 250g; ballistic visor 1kg; neck protector 500g (APH4 320g).

**Siege Shield:** This is a body-length shield fitted with carrying handles and an observation window in bullet-resistant nil-spall glass. It can be folded for use in restricted spaces.

**Data:** *weight* 12kg; *height* 1.83m (extended), 1.15m (folded); *width* 0.58m.



### Ministry of Defence Body Armour

**EOD Suit Mk 2:** This is intended to give protection against fragments, blast and flame to personnel involved in the disarming of small IEDs. It also provides a measure of protection at greater ranges from larger devices. It is believed that the minimum requirement for the suit is that it should withstand a 250gm nail-bomb exploding at a distance of 0.9m. The suit consists of a jacket, trousers and cape, each containing a filler of a ballistic protective textile with a fire retardant textile cover. In the case of the jacket and cape, the ballistic fillers are removable to aid laundering, and in all three items the fillers are encased in PVC envelopes to exclude moisture, which degrades ballistic performance. The jacket has a high collar providing protection for the neck and lower face and is provided at the front with two large pockets to accept reinforced plastic breast and pelvic plates, which give added protection to the vital organs of the body. Pockets are provided on both the back of the suit and the cape to accept a radio and tools required in disposal operations. The jacket and trousers provide ballistic protection only at the front; the cape provides back protection if required. The helmet has a textile laminate shell and incorporates a sound-excluding communications headset. The visor screen is a two-part plastic system with intervening air gap. (See also Gault Glass Laminates.)

**Employment:** British Army.

**Weights:** suit 14.6kg; helmet 4.5kg; plates 4.6kg.

**Fragmentation Vest, Collar and Abdominal Protector:** This fragmentation protective vest is a development from an original US Army item and is intended to provide protection against fragmenting munitions for the neck, thorax and upper abdomen. The two pockets have been enlarged to accommodate a personal communication radio, and non-slip patches are attached to each shoulder to prevent rifle-butt slippage. The vest consists of an outer cover of textile, which fastens at the front with a touch and close fastener and down the sides with adjustable lacing. The filling consists of 16 piles of textile sewn together and stiffened with plastic sheeting. Total weight of the jacket is 4.11kg.

The Fragmentation Protective Collar is intended to be worn in conjunction with the fragmentation protective vest to give greater protection to the neck and lower part of the head against fragments from IEDs. It was developed specifically for the use of members of teams searching for such devices. The

**Left:** The British Ministry of Defence 'Suit Explosive Ordnance Disposal Mk 2'.

**Below:** The MOD Fragmentation Vest, which has long been in service with the British Army.

**Below right:** The MOD IED helmet, here seen in prototype. This is for search teams as opposed to EOD operatives.

Abdominal Protector is a compulsory item to the Fragmentation Vest and Collar and is intended to protect the lower abdomen and pelvic areas against fragments from fragmenting munitions and IEDs and afford some protection against blast.

**Employment:** The Vest and Collar are in service with the British and US Armies, and the Abdominal Protector with the British Army only.

**Helmet, Anti-Riot Transport (HART):** A commercial crash helmet to which has been added a transparent plastic visor to enable it to be used as an anti-riot helmet. The visor and helmet shell will give protection against hand thrown missiles but are not intended to provide ballistic protection. The helmet in addition provides a level of crash protection equivalent to that specified in BS1869 (protective helmets for racing motor cyclists) for the protection of vehicle occupants.

**Employment:** British Army.

**Helmet, IED Search Teams:** The helmet is intended to provide ballistic protection to members of teams searching for IEDs and explosives. The helmet is similar in design to

commercial crash helmets, but has a ballistic protective shell moulded in a nylon or Kevlar textile/resin laminate. Ballistic protective visors of various thicknesses are provided and audio gear for interfacing with communications systems and detection devices is fitted. Removable plugs over the ears aid hearing when audio gear is not required.

**Employment:** British Army.

**Internal Security Combat Helmet:** The British Army has developed a type of internal security helmet known as the IS Combat Helmet. The helmet, which is made of composite material and incorporates a visor plus a new type of chinstrap liner, is lighter, more comfortable, more secure and gives a higher degree of ballistic protection than the general issue Mk 4 steel helmet. The wearer can also hear a great deal more easily than with the enclosed type HART currently in service. The polycarbonate visor is readily detachable, and a helmet cover can be added for operations in a rural environment.

**Employment:** British Army.

**Weight:** helmet 1.41kg; visor 0.41kg.

**Protector, Leg, Anti-Riot:** The equipment is



PROTOTYPE I.E.D.  
SEARCH HELMET.



**Below:** The MOD Internal Security Combat helmet.

**Below right:** MOD Anti-Riot leg protectors. These are not intended to stop bullets and are merely intended to prevent injury from bricks and other missiles. They are still available for issue but are not currently popular with personnel.

**Opposite page, top left:** The moulded pattern riot shield.

**Opposite page, bottom:** Variable body armour. This is a very flexible modular system into which different ceramic plates can be inserted for various levels of protection.

**Far right:** The PDI Protector Riot Shield.

intended to protect the fronts of the lower legs from impacts of hand-thrown missiles in riots. The protectors consist of thin moulded plastic sheets backed by polymer foam sheet to dissipate the energy of impact. The same pattern is used on both right and left legs and fastening to the legs is by means of two webbing straps passing behind the leg and secured by touch and close fasteners.

**Employment:** Though still available for use, this item has not been worn in Northern Ireland by the British Army for some years.

**Shield, Anti-Riot (Moulded Pattern):** The shield has been developed to afford protection against hand thrown missiles in riot situations without interfering in any way with the user's field of view. It consists of a moulded transparent plastic sheet with curled edge to promote greater rigidity and formed centre to provide a measure of side protection. The arm band has a touch and close fastening to enable quick release, and the forearm is protected by a foam sheet to absorb impact energy. When in use, the centre of gravity of the item falls inside the user's arm and thus prevents any torque being exerted on the arm. The equipment weighs 2.7kg.

**Employment:** British Army.

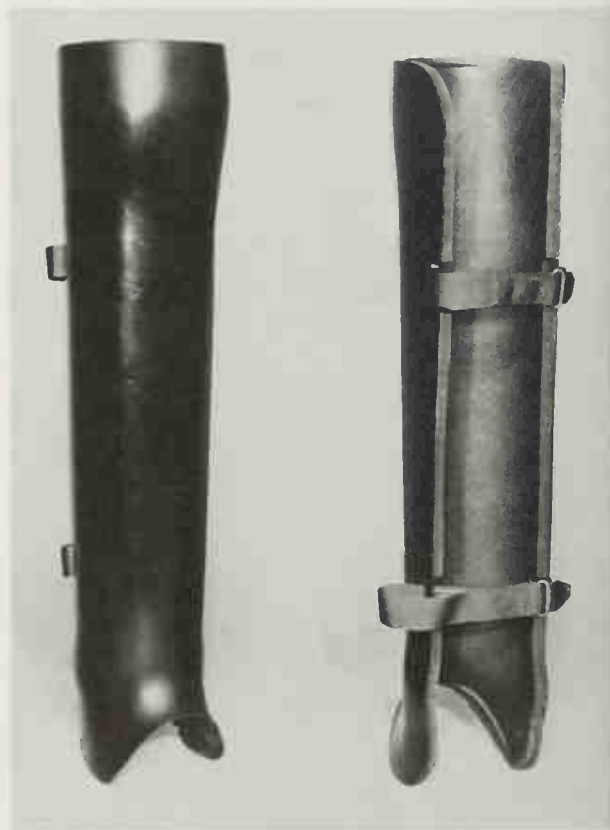
**Variable Body Armour:** The British Army has adopted in limited quantities an armoured jacket known simply as Variable Body Armour. Offering a considerably greater degree of protection against 7.62mm high-velocity rounds than the old 'flakjacket', the VBA consists of a light protective jacket with pockets front and rear, into which heavy metal plates are inserted according to the degree of protection required. Weight considerations make it likely that the suit is more usually worn by vehicle-borne troops or those deployed in a semi-static role. Gross weight is 12kg. The equipment is a modification of a US Army equipment.

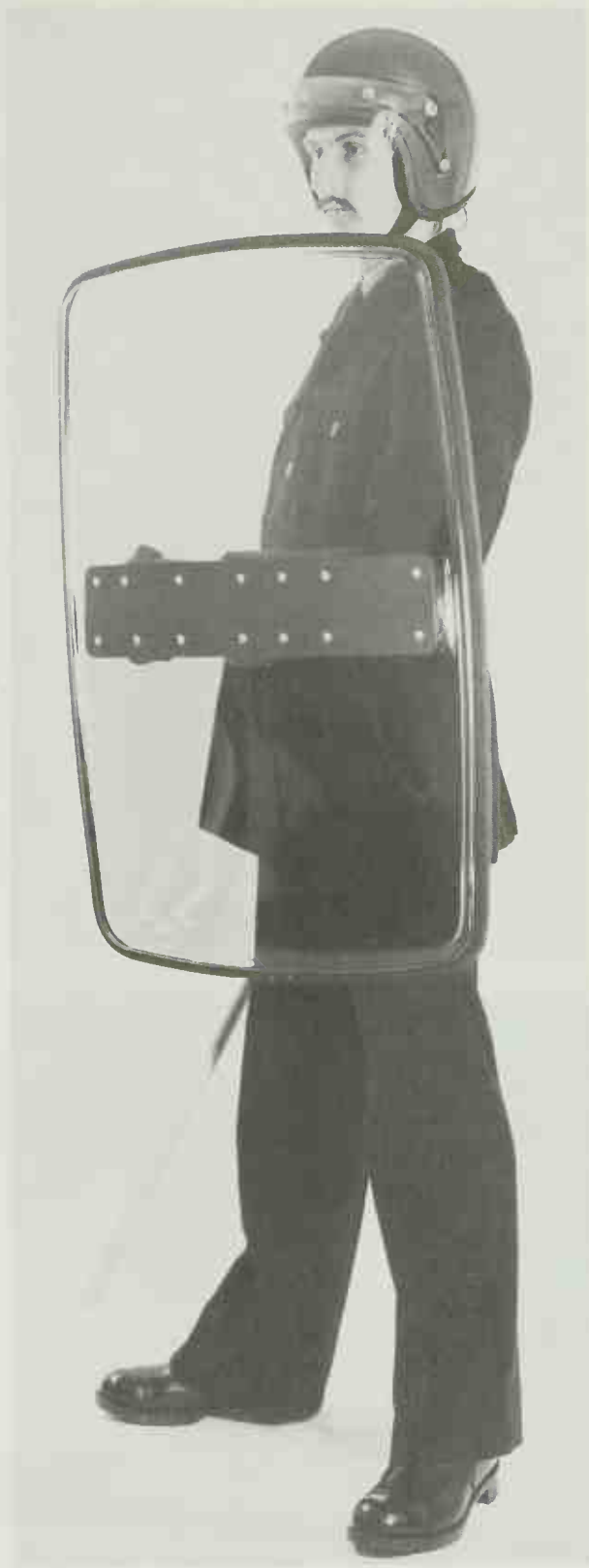
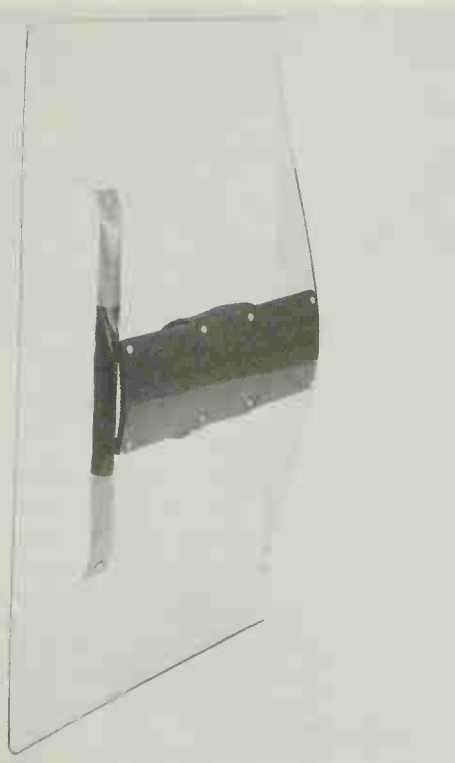
**Employment:** US Army, British Army.

### PDI Protector Shields

Manufactured by PDI of Birmingham from Lexan polycarbonate, the Protector Riot Shield is lightweight (3.18kg), transparent and tinted to reduce dazzle, and sufficiently flexible to deflect missiles. The peripheral gutter helps to disperse liquids hurled at the face. PDI also manufacture visors for anti-riot helmets.

**Employment:** PDI Anti-Riot Visors are used by the British Army.





### Racal Amplivox EOD Helmet

Manufactured from anti-ballistic material, the helmet provides protection from blast and fragments and is fitted with Sonovalve acoustic valves to protect against transient explosive noises. Full communications facilities are also built in, including a specially developed microphone with sound conveyed via an acoustic tube incorporating a sibilant filter and detachable background noise attenuator, such that the system eliminates the hazards of mounting a conventional boom microphone in front of the wearer's face.

**Employment:** British Army.

**Data:** weight 4.7kg; fits head lengths from 186mm to 207mm.

### Royal Ordnance Riot Shields

Two shield models are on offer, both made of polycarbonate. The Squad Leader Shield is of 3mm clear material and fitted with an ABS-faced foam pad for impact absorption. The Snatch Variant Shield is lightweight (less than 2kg) and circular, 600mm in diameter.

**Variants:** Alternatives are available in sizes up to 2 metres long and from 3mm to 6mm in thickness; they can be flat or curved, and a quick-release handle is also available.

### SAS Developments SA12 Series Riot Helmets, Visors and Shields

**SA12 Riot Helmet:** The standard helmet supplied specifically for riot squads is manufactured from polycarbonate, which is of high-impact grade and offers a high degree of impact protection and penetration resistance, coupled with an exceptionally light weight. The helmet shell will resist penetration by a spiked cylindrical steel striker weighing 1.8kg dropped from a height of two metres; it will also resist at least six blows of 90ft-lb impact (the equivalent of 0.46kg weight dropped from 27.6m).

**Visor:** Made from 3mm thick polycarbonate, these are designed to fit the latest SA12 Riot Helmet, as well as NATO and standard British Mk IV Steel Helmets, although fittings suitable for any type of helmet can be provided. All visors are supplied with a hinge, allowing them to be raised away from the wearer's face when not in action. The clearance of the visor from the wearer's face is such that the visor cannot come into contact with his skin even if it is hit with a wooden or iron bar. A 'stop' can be provided so that the visor can be maintained in one or two alternative raised positions.

**SA12 Shields:** These are available in several different shapes and designs. The standard



**Top left:** The Racal Amplivox EOD Helmet. Note the inbuilt microphone so that the EOD operative can communicate with his back-up team.

**Below left:** SAS Development's SA12 Riot Helmet (pictured here with the Shockstick; see page 121).

**Right:** Royal Ordnance Riot Shields. Left, the Snatch Variant; right, the Squad Leader.



shield is 913mm long, and 508mm wide, and weighs 2.25kg. It has a shock-absorbing foam-rubber arm pad. The shield is constructed of 3mm thick polycarbonate.

**Employment:** These equipments are in use with various armies and police forces. In particular, SAS visors are used by the British Army on the Mk IV Steel Helmet; however, this helmet is in process of being replaced by a new infantry combat helmet.

### Security Equipment Supplies Body Armour

Like many other manufacturers, SES of Andover, Hampshire, use Kevlar in their garments, building layers to increase ballistic protection, and ceramic tile inserts further increase effectiveness. Customized armour is available in addition to the basic patterns, which include the following.

**EOD Suit Mk 4:** In service in Europe, the Middle East and the Far East, this suit

features overboots that protect the feet and ankles, a blast deflection plate covering the chest and groin area and a fully air-cooled ballistic helmet with integral visor and built-in microphone and earphones.

**Data:** weights 7kg (jacket), 2.5kg (trousers and overboots), 4.5kg (chest and groin), 1kg (cooling fan), 1.5kg (cooling fan battery), 4.5kg (helmet); *cooling fan running time* 8 hours; *cool air flow* 180 litres per minute; *ballistic levels* from 360m/second V50 (trousers, arms and overboots) to 700m/second V50 (visor).

**Ambassador Model:** Designed to be worn over uniform by police and military personnel, this garment protects front, back and sides, and a groin protector can be fitted. More than 14,000 of these jackets are in service.

**Assault Jacket:** Offers total protection to the upper area of the body, with large adjustable sides and collar adjustment; magazine pouches come as an optional extra.





Body Armour from Security  
Equipment Supplies.

**Far left:** EOD Suit Mk 4.

**Left:** The Ambassador  
Model.

**Below left:** The Assault  
Jacket.

**Top right:** The SES Flak  
Jacket.

**Top far right:** The SWAT  
Model.

**Below right:** The Diplomat  
concealed armour.

**Below far right:** The  
Protective Waistcoat.

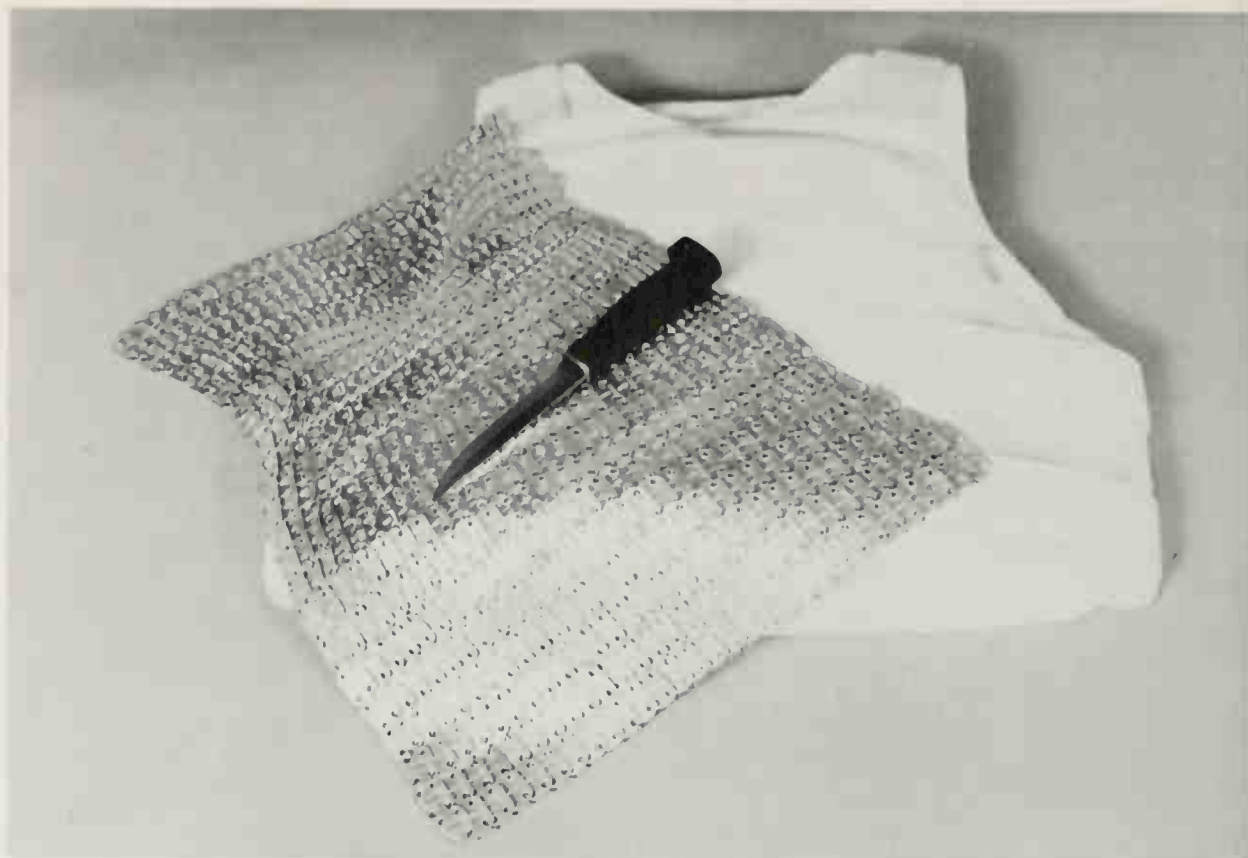




Security Equipment Supplies  
body armour. Here are  
versions of the Immediate  
Response Jacket worn with  
balaclava helmets (useful for  
psychological effect as well  
as camouflage in dimly-lit  
buildings). The jacket is  
much lighter and more  
flexible than the old webbing  
equivalents and affords rapid  
access to the weaponry and  
stores being carried. This  
can be worn in conjunction  
with body armour. The  
weapons depicted here are a  
silenced Sterling  
submachine-gun and a  
silenced 9mm Browning  
automatic pistol.







**Above:** The Anti-Knife Jacket from Security Equipment Supplies.

**Flak Jacket:** Primarily designed for the military use, this jacket features patterned stop patches at the shoulders to aid weapons grasp.

**SWAT Model:** A fully adjustable jacket that offers maximum protection area while allowing unrestricted movement.

**Diplomat:** This is designed to be worn under a shirt and offers good protection for the user while concealing the fact that body armour is being worn.

**Anti-Knife Jacket:** Based on the Diplomat model, this offers protection against stiletto knife attack; the anti-knife insert has a lightweight lamellar metal section fronting the Kevlar packs at the front and back of the jacket.

**Waistcoat:** This looks identical to a normal cloth garment.

**Immediate Response Jacket:** Designed for specialized forces, this is a lightweight (1.5kg) garment that makes use of nylon netting material to remain cool in tropical climates.

### **Triplex Bullet-Resistant Glass**

Triplex produce a range of tailored bullet-resistant products designed to customers' specifications with additional features avail-

able such as Triplex Hyviz electro-conductive film for rapid de-misting, de-icing and for alarm systems. Special tints are also available offering varying degrees of colour density. Thus, the crews of payroll vans or military vehicles whose work puts them at risk of violent attack, and VIPs who have to travel in sensitive areas, can be protected.

**Employment:** A variety of private customers in South America and the Middle East employ Triplex glass on private motor cars. In addition the glass is fitted to the Shorts Armoured car used by the Royal Ulster Constabulary and to the GKN AT-104 armoured patrol vehicles.

### **Trojan Protective Garments and Equipment**

Manufactured by HPP (UK) Ltd., of Birmingham, this is a range of protective accessories including helmets, leg and arm guards (weights 720g and 520g per pair respectively), shields and horse boots. The latter are of hard rubber and are claimed to last 8-10 times longer than a conventional steel shoe. The shields are in clear, shatter-proof 3mm or 4mm polycarbonate and come in three sizes:

**Below:** Volumatic's Anti-Bomb Curtain. This type of curtain can be found in government and military buildings throughout the UK; the weighted base ensures that the curtain retains flying glass from a smashed window.

**Below right:** A demonstration of how tully treated armoured glass remains intact under blast instead of breaking into a shower of lethal fragments.

90cm × 60cm (2.5kg), 180cm × 60cm (4.5kg) and a 56cm diameter circular version (1.6kg).

### **Vacuum Research Camsafe Shatter Resistant Film**

An increasingly used method of combating the problem of flying glass caused by a terrorist bomb is the use of shatter resistant film, which, when applied to a window, holds the particles of glass together after breaking and restricts the scatter of glass fragments. Camsafe, developed by Vacuum Research Ltd., is virtually undetectable and, once the adhesive has set in approximately 14 days, forms a strong glass-to-film laminate. Camsafe is based on Melinex polyester film supplied by ICI. It has been tested under explosions of different magnitudes, and in all these tests the

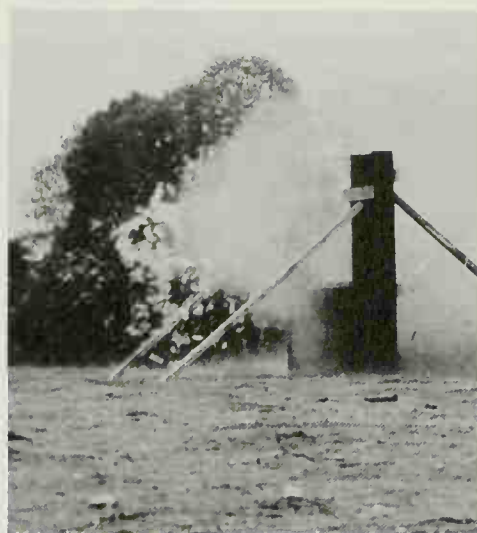
shattered glass was held together by the film, and glass fragments were restrained.

**Employment:** Camsafe is in use in the United Kingdom, and several other countries.

### **Volumatic Anti-Bomb Curtains**

Developed by Volumatic in conjunction with Filigree Textiles Ltd., of Nottingham, the net curtaining is designed to the specification laid down by the UK Department of the Environment's Property Services Agency for the protection of its own buildings. The purpose of the curtains is to prevent flying glass from an explosion causing serious injury. The bottom of the curtain is weighted at 400g per metre width.

**Employment:** United Kingdom Department of the Environment.



**Below:** American Body Armor protective undergarments for ladies. On the left is the Contour Style model; on the right the Side Coverage style model. All vests made by this manufacturer are provided with a removable ballistic steel 5in x 8in 'shok' plate which can be contoured to bust size

## UNITED STATES OF AMERICA

### American Body Armor Equipment Inc. Protective Garments and Equipment

American Body Armor Equipment Incorporated of Fernandina Beach, Florida, provide a comprehensive range of body armour, facemasks, helmets, shields, barrier blankets and EOD suits. They also manufacture bomb handling equipment and letter bomb suppression pouches.

**Vests:** Two female vests are available, the Contour Style and Side Coverage Style. They provide protection up to and including 9mm calibre rounds. Two male vests are available, with protection similar to the female vests.

**Armitron Body Armor:** Armitron provides one-piece 'soft body armour' protection

against 9mm and .44 Magnum projectiles. This is a most impressive performance, since no metal plates are incorporated. It is most suitable for police on undercover work.

**Tactical Jacket:** A conventional flak jacket with good protection against low-velocity rounds and shrapnel. To upgrade the jacket, a ceramic plate can be inserted into the front and/or rear pockets of the vest, and this will provide protection against projectiles up to and including 7.62mm and 5.56mm.

**Tactical Assault Vest:** The Tactical Assault Vest offers similar protection to the Tactical Jacket but is less bulky and can be worn more easily with load-bearing equipment. Ceramic plates can also be inserted.

**High Coverage Tactical Armor:** This armour provides comprehensive protection against handguns, shotguns, and submachine-guns



and, with the addition of the 'ceramic throw over', against rifles.

**Model AK-47 Lightweight Military Body Armor:** This armour is designed for military use and is one of the lightest vests available that, with ceramic plates, can defeat high-velocity rifles. It weighs 2.65kg. The 25cm × 30cm ceramic plate weighs another 3.63kg.

**TAC-100R Tactical Facemask, TAC-22R Tactical Helmet and TAC-300R Tactical Protective shield:** The Facemask protects the face from most handguns, shotguns and sub-machine-guns, providing valuable protection and a strong psychological advantage. The mask is constructed of Kevlar. If a round hits the mask, the amount of energy transferred to the head and neck is claimed to be comparable to the impact received from a good punch

to the head. It weighs 0.57kg. It is best worn with the Kevlar TAC-200R helmet, weighing 1.71kg, and the TAC-300R Tactical Protective shield, 83cm × 48.5cm, weight 5.45kg.

**Riot Vest:** This comes in three versions, Model 210 for protection against handguns and weighing 3.63kg; Model 310 for better protection against handguns and weighing 4.54kg; and Model 620 for protection against up to .30 calibre rifles and weighing 8.18kg.

**Barrier Blanket:** The Barrier Blanket is a lightweight bullet-resistant barrier, proof against handguns, shotguns and submachine-guns. It can be used in a variety of siege or hostage situations to create safe zones.

**BBS-3 EOD Suit:** This is a well designed and engineered EOD suit that is thought to provide a high grade of protection for EOD operations.

**Right:** American Body Armor protective vests for men. On the left is the Contour Style model; on the right, the Side Coverage Style model.







American Body Armor protective garments.

**Top left:** The Tactical Jacket.

**Above left:** High Coverage Tactical Armour Model A1-ESU-1.

**Below far left:** Armitron IIIA, with ABA's patented 'Black Magic' technology.

**Below left:** Low profile protection is afforded by ABA's Executive Vest. As with other garments, the levels of protection vary according to the grade of material used.

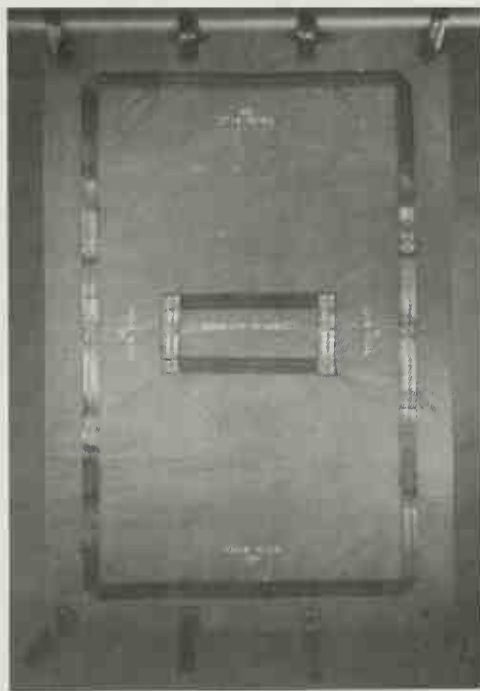


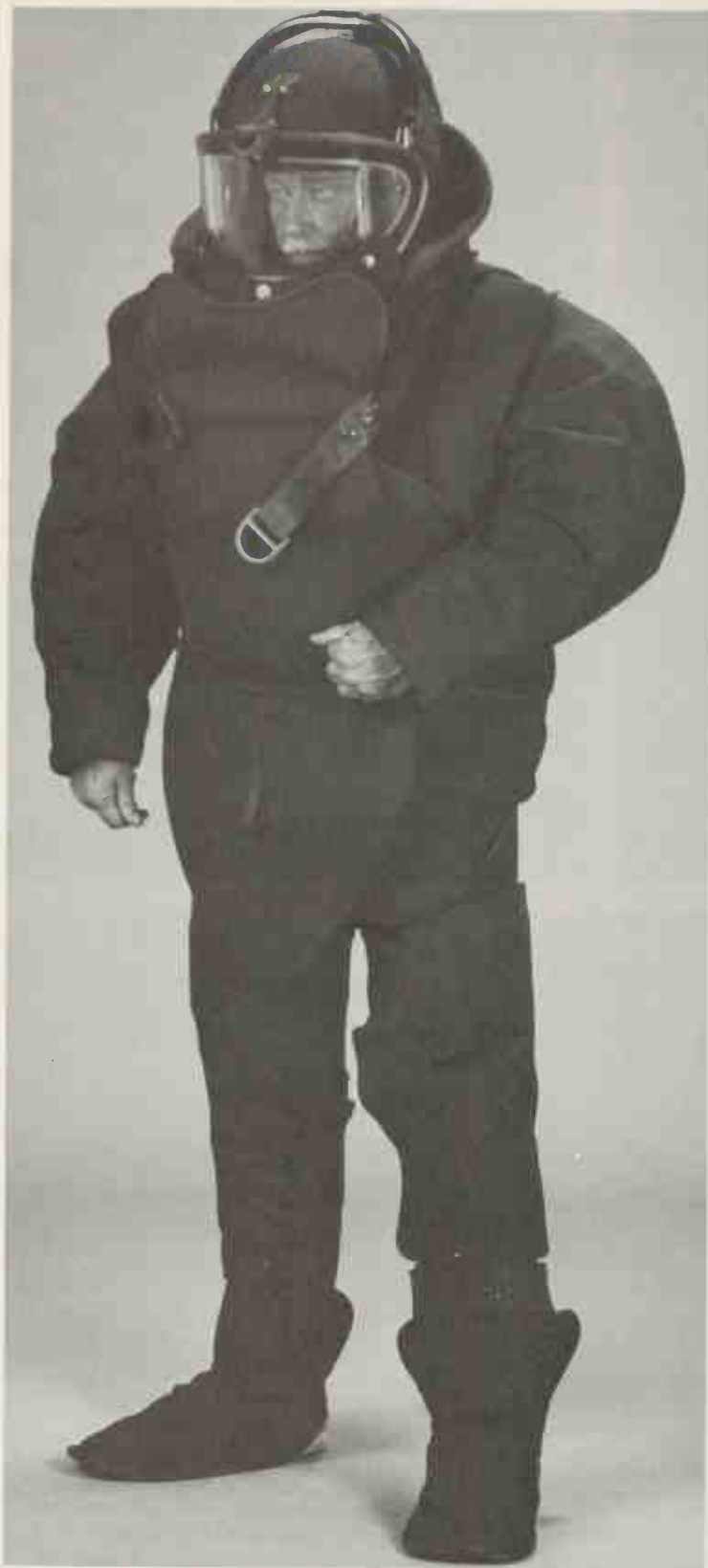
**Above:** aK-47 Light Weight Military Body Armour, claimed to be the world's lightest unit of military armour.

**Above right:** The TAC-100R Tactical Facemask, which is made of Kevlar.

**Right:** The Riot Vest, which comes in three levels of protection, with weights from 3.63kg to 8.18kg.

**Below far right:** The American Body Armor Barrier Blanket; this folds down to 61cm × 46cm × 25.4cm.





**Far left:** The American Body Armor EOD Suit Model BBS-3, which boasts armadillo-type overlap arms, a removable chest protector, inner leg artery protection, anti-static and flame-resistant material.

**Left:** The Armor of America Tactical Vest.

**Below left:** The Armor of America Sacramento Vest.

## **Armor of America Protective Garments**

**Sacramento Vest:** Developed by Armor of America of Beverly Hills, California, the Sacramento Vest is designed for use by police and SWAT teams. It is designed to hold chest and back panels of any grade of hard armour. A sleeveless garment, reinforced with ballistic nylon felt that acts as a shock absorber when hit by rocks and bottles, it is also ideal for crowd control. Without an insert, the Sacramento Vest can stop 9mm submachine-gun fire at 8m and weighs 4.08kg (SAC AHP Version). A Sacramento Armour Shield insert weighing an additional 2.88kg will stop a 7.62mm NATO round at 8m. The garment also protects the neck, spine and groin.

**Employment:** Various US SWAT teams and police forces.

**Tactical Vest:** Without a hard armour insert, this vest can stop a 9mm submachine-gun

round at 8m. With an insert of Bristol Armour, the Tactical Vest can stop up to 30.06 AP. The vest is available in two versions, the AJ weighing 4.54kg, and the AHP weighing 2.72kg.

**Employment:** Various US police forces.

**Undershirt Armoured Vest:** Armor of America has developed a range of lightweight vests for undershirt wear. These provide protection against most handguns and include Armour-Hide (1.1kg), Super Armour-Hide (1.7kg), Super Armour-Hide Contour (1.81kg), Armour-Hide Super Contour + P (1.5kg) and Ultra-thin (0.89kg). The Armour-Hide range offers slightly differing levels of protection, but all are of the same basic design.

**Employment:** Various US police forces.

**Woman's Vest:** Designed for policewomen, this vest can stop virtually all handgun rounds,



**Right:** Armor of America's protective vest for women.





**Above:** The Burlington Riot Jacket. This is a standard flak jacket, note the Velcro fastening, common on such garments.

**Above right:** Second Chance's Hardcorps II body armour.



including .38 calibre, 9mm HP and .41 Magnum. It weighs 0.91kg, and is available in sizes 32, 34, 36 and 38.

**Variants:** The women's vest is available in a version providing a slightly higher degree of protection against 9mm FMJ (USA) and weighing 1.1kg.

**Employment:** Various US police forces.

### **Burlington Body Armour**

**Riot Jacket:** Designed for protection during riots, the Burlington Riot Jacket is made of ballistic nylon. It provides protection against .38 and .45 (lead nose) projectiles. The jacket weighs approximately 5.5kg.

**TAC Jacket:** This provides full coverage of the front, back and sides of the upper torso, as well as the shoulders, all at high protection levels. The jacket is constructed of Kevlar and PM-1300, a specially treated material developed by Protective Materials Co. to reduce blunt trauma. These materials allow the TAC Jacket to defeat all handguns, shotguns and submachine-guns up to and including the .44 Magnum, and most 9mm ammunition. A front pouch is provided to accommodate an Assault Plate, which protects the vital organs from frontal attack up to and including the 30.06 armour-piercing projectile.

**Bullet-Resistant Vests:** These are designed for wear underneath clothing. The 7840 is made of ballistic nylon.

**Employment:** New Orleans, Philadelphia and Chicago police departments.

### **Second Chance Body Armour**

Hardcorps Body Armour, developed by Second Chance Body Armour, claims to have saved the lives of 351 US policemen up to 31 December 1985.

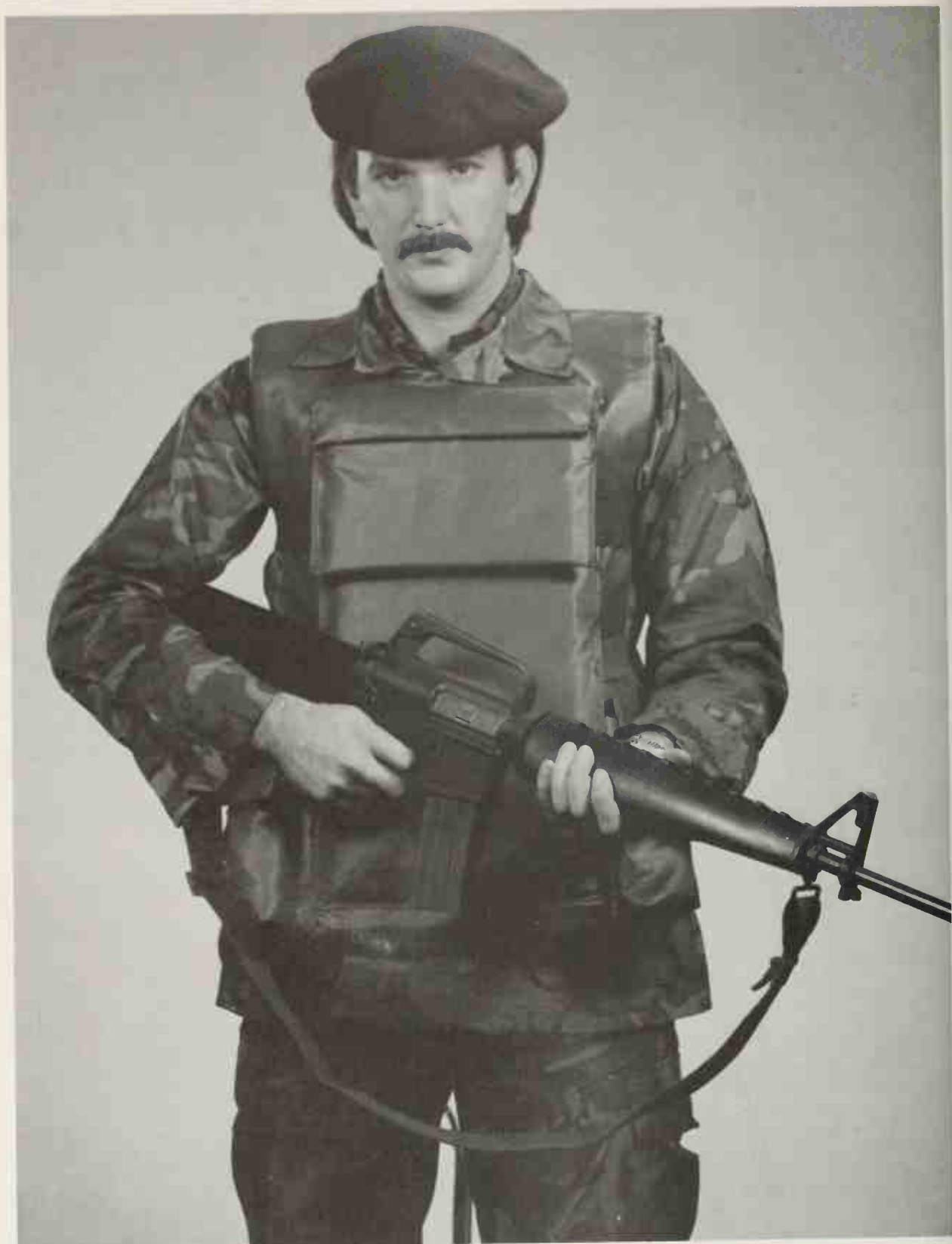
**Command Jac Assault Vest:** Provides complete torso protection against .30 US carbine and all known handgun rounds. An armour plate is an optional insert for protection against AP rifle fire. The jacket is suitable for police and SWAT team wear.

**Hardcorps II:** Hardcorps II is available in one standard size, 32cm × 38cm. The soft ballistic panels (without metal inserts) offer protection from shell fragments, handguns and shotgun parabellum. Also available is a contoured 25cm × 33cm armour plate assembly that provides protection against high-velocity AP rounds. The same plate can be inserted for back protection. Hardcorps II (without the plate) weighs 1.8kg; the insert is 4.9kg.

**Hardcorps III:** An all-purpose body armour system offering the wearer 80.4cm<sup>2</sup> front and

**Right:** The Second Chance  
Body Armour Command Jac  
Tactical Vest.





**Left:** Second Chance  
Hardcorps III body armour.

**Right:** Hardcorps IV.

**Below right:** Second Chance  
Concealable Armour.



back protection from shell fragmentation, handguns and shotguns. There are three frontal inserts and an optional back guard insert. These provide protection against high-velocity rounds. Hardcorps III without the plate weighs 2.47kg; with frontal plates total weight is 8.38kg.

**Hardcorps IV:** A logical development of Hardcorps III, with an extra front panel. It has the same level of ballistic performance.

**Concealable Armour:** For use by VIPs and police, this affords protection against handguns; with the K30 plate inserted, there is additional protection against high-velocity weapons.

**Employment:** Second Chance Body Armour is used by some 50 police departments in the USA, including the San Francisco, Detroit and Chicago Police, the Texas, Ohio, Massachusetts Police Departments, the Michigan State Police, and the FBI.

### Sierra Protective Garments

**Ballistic Helmet Model SD357:** Weighing 1.91kg, SD357 has been developed by the Sierra Engineering Co., of Sierra Madre, for use by police and anti-terrorist personnel to provide protection against .357 calibre handguns fired from a range of three metres. The helmet is provided with a chinstrap and visor.

**Ballistic Helmet Model GP380:** Weighing only 1kg, GP380 provides protection against .38 calibre handguns fired from a range of three metres.

**Employment:** Various US police forces.

**Body Armour:** Sierra has produced a 1.6kg assault body armour jacket for wear in all combat situations. Its low weight makes it very suitable for use by IS forces for patrolling in urban or rural areas.

**Employment:** Various US police departments.

### Smith & Wesson Protective Garments

**Helmet Model 68:** Specially designed for riot duty, the Smith & Wesson Model 68 Helmet is constructed of pressure-moulded glass-fibre with polyester resin. The removable visor permits attachment of a face shield, which can be worn with the Model 67 Smith & Wesson Riot Gas Mask.

**Barrier Vest Body Armour Model 217:** This contains ballistic steel protection in both the front and the back. Seven layers of barrier cloth are bonded to the steel at the back, and ten layers at the front. Without the detachable groin protector the Model 217 weighs 4kg. The groin protector weighs 1kg.

**Employment:** Various US police departments.



# Surveillance, Security and Perimeter Protection Equipment

Surveillance equipment, though important in conventional warfare, is especially so in IS conditions. In modern warfare, Image Intensification (II), Infra Red (IR), and Thermal Imaging (TI) weapon sights are commonplace in order to facilitate the 24-hour battle. Though night and all-weather sights are important in rural IS situations, surveillance aids as opposed to weapon sights are particularly important for observation posts (OPs) that may be keeping watch on a target for days on end. Time spent in surveillance is seldom wasted and often pays dividends out of all proportion to the effort involved. Indeed, a successful operation is often preceded by hours, weeks or even months of painstaking surveillance. Telescopes are a basic aid for daylight static observation tasks. These often have a zoom facility, which has proved highly effective. The basic range of IS night viewing aids has been augmented in the British Army with Pocketscope, a hand-held, second generation II monoscope, the small size of which has made it extremely popular with patrol commanders.

White light illumination at night is equally important, particularly in a search operation. Search or bomb disposal teams are now able to use 20K candle-power torches for night illumination. Helicopters are also able to illuminate the ground with Nightsun (see page 49).

Cameras are, of course, a vital tool in IS operations. In order to secure convictions, it is often necessary to have photographic evidence, for instance, of an illegal weapon in its hiding place before removal for forensic tests. Polaroid cameras can be used remotely in bomb disposal for making a rapid appraisal of an IED. This can also be done by means of a TV camera and remote monitor. In Northern Ireland something like one man in every eight is equipped with a camera for the purpose of securing evidence. (It is not proposed to feature cameras as such in this chapter.) Another fascinating use of camera equipment for IS purposes is the remarkable air-to-ground surveillance and reconnaissance system known as Heli-Tele. The system consists of a colour TV camera mounted on a helicopter, a micro-

wave link with multi-range aerials and a number of display units both in the helicopter and at a ground station to which the camera transmits a 'real-time' picture. (The technical details of this system are included in IS equipment for helicopters on page 49.)

Radar also has an IS application. Infantry has long used short-range portable surveillance radars in conventional warfare. Examples are the French Thomson-CSF Olifant 2 Radar and the British Marconi Elliott ZB298 Radar. This type of equipment, although primarily designed for use in conventional warfare, is especially suitable for surveillance of a border, extending the zone observed by a patrol, or even surveillance of boat traffic in a river – all possible IS tasks in a rural environment. Another application of radar for a specifically IS task is Claribel, a British development. This is an active radar surveillance device that indicates to within a 30° arc the direction from which a sniper has fired. Vehicles or static OPs can be fitted with sensors. If fired at, the system provides audio warning that a shot has been fired and a visual indication to identify the 30° arc from which the shot came. In a built-up area it is virtually impossible for an unequipped observer to tell from which direction a shot has been fired, as the 'crack and thump' of a high-velocity rifle echoes and re-echoes off the walls of the buildings.

Perimeter protection has become a growth industry since military and government installations have, in recent years, become more prone to sabotage, espionage and plain vandalism. The airport, the nuclear plant, the oil terminal, the power station, the armaments store, the radar site, the ordnance factory, the communications centre, the ruler in his palace, the general in his headquarters or the politician in his seat of government – all these target are vulnerable and in many cases more vulnerable than they need be. Terrorist organizations worldwide have demonstrated their ability to attack the infrastructure of the state. Intruder alarms provide varying degrees of security. The main aims of a perimeter protection system are to provide the

earliest possible detection of intruders; to maximize reaction time; to ensure security against overcoming the system by tampering; to give a low (preferably negligible) false alarm rate; to ensure reliability over long periods as well as ease of installation; and ideally the system should provide protection in depth.

Perimeter protection can be provided by microwave/IR fences, tripwire/differential-force systems, by acoustic, seismic or magnetic sensors, or by radar or TV surveillance. Often a combination of these systems is the best answer. Sensors can provide protection in a number of ways: they can detect an intruder crossing a line, they can detect attempts to climb or interfere with fences or walls, and they can sense interference with windows. Additionally or alternatively, they can be used to provide focal protection so that the presence of a person in a room is indicated. Most perimeter protection systems are connected to a central control or station, thus keeping to a minimum the manpower required to monitor them. Ideally any security system installed should perform the following functions:

- Deter an intruder from entering;
- Detect a security threat before it happens;
- Sense an intrusion when it takes place and pinpoint where it has occurred;
- Locate the intruder so as to determine the nature of the threat; and
- Respond to the threat and neutralize it.

A large installation will be covered by a multi-camera installation with the control unit in one central location. The only time it should be necessary to go to the camera head is when a sensor tube needs changing, which is normally only once in several thousands hours of operation. The type and method of use of the camera varies depending on the site and the required system parameters. The first main consideration in designing any system is to determine what is to be viewed and why. Having established this, the site is surveyed so that the type of cameras and their locations may be decided upon. In some instances, when it is required to have con-

tinuous surveillance of the whole perimeter, it is necessary to position fixed cameras with fixed fields of view at regular intervals all around the site. On a rectangular site, for example, the cameras could be divided into four groups, one for each side, and each group would be allocated its own picture monitor. The pictures from the cameras could be selected for viewing on the appropriate monitors by manual selection, or they could be made to sequence automatically, the sequencing switch having a manual override. As the cameras are fixed, there are no remote controls, so the system is kept simple. It has a high security integrity, as any one camera will cover part of the next camera's field of view and, if a camera fails, all is not lost. It does mean, however, that a relatively large number of cameras may be required, and the cameras are restricted to viewing only one area; there is therefore some inflexibility.

An alternative type of installation is where remotely controlled cameras are installed. With this arrangement, a camera can be remotely positioned to view any required area within defined limits. The cameras are mounted on pan-and-tilt heads and controlled from a remote point by means of a simple joystick. Associated with this type of installation, it is normal to fit a zoom lens, which is also remotely controlled. In use, the camera is made to pan around and tilt up and down to observe any given area of the perimeter, with the lens at a wide angle. When it is considered that an area needs closer inspection, the zoom lens is brought into operation to give a close-up view of the suspect area. The advantages of this type of system are that it is very flexible, large areas can be viewed with one camera, and close-up views can be obtained. On a one-for-one basis, this is more expensive; but, generally, fewer cameras are used, to the point where its overall capital cost is lower than that for fixed cameras. On the other hand, it is a more complex system, with remote-control circuits, associated cabling and more unit parts required to make the whole. An intruder could, if he were clever, aim to be where the camera was not pointing. The system's integrity could be seriously affected by

failure of any one function or camera, unless fully compensating camera positions were designed-in.

There is another vulnerable aspect to a system using only television cameras: it relies on a man to continually monitor the pictures. This can be a tedious operation, and, in the case of movable cameras, they may not be viewing the right areas, so an intrusion may go undetected. For a large installation, the many viewing screens required would complicate the matter. This problem is overcome by employing a system that *automatically* detects the presence of an intruder. This can be achieved by use of geophones (seismic microphones) or by the use of infra-red beams. A security system could include either of these or a combination of them. Geophones will detect the presence of an intruder by sensing the vibrations set up by his activity. The wide variety of methods of geophone deployment allows their use in many roles: on fences (more usually), in paths or buried directly in the ground. The sensitivity of a geophone is such that virtually any activity in its vicinity will cause sufficient vibration to provide a working signal to the system. Even so, it is a robust and wholly passive device.

Geophones are employed in multiple arrays. There is interconnecting wiring between each geophone unit within the array and from the array to the control units. It is usual to mount geophones on chain-link perimeter fences, on alternate fence panels approximately six metres apart. The fence is divided into sectors, each of which can be up to 150 metres long and employ 25 geophones. The length of the sector will depend upon the application and the overall system configuration. Up to eight sectors can be accommodated in one control unit, and several control units may be housed in a single equipment rack. The geophone itself is a seismic detector that, when mounted on a fence, operates in the vertical plane. It consists of a finely balanced coil suspended within a magnetic field. Any movement of this coil induces a voltage proportional to the amplitude and frequency of the movement. The induced voltage is detected in the control unit, where any significant change is signalled as an alarm. A single small movement would not be significant, but a series of small movements – such as an intruder sawing gently through the wire – would be detected and signalled as an alarm.

Infra-red systems constitute the third main category of surveillance systems. An infra-red source (the transmitter) provides a cone of infra-red 'light' which illuminates the infra-red receiver. No visible light is emitted by the transmitter, and each one can generally illuminate more than a single receiver.

Both transmitter and receiver are optically focused so that a relatively narrow beam exists between them. The receiver will respond to either an increase or a decrease in the received signal. The infra-red beams will operate in all weather conditions where the transmitter can be seen visually from the receiver. Generally, multiple beams are deployed to form a fence of infra-red. This fence can be of any height and with inter-beam spacing to suit the circumstances. Infra-red transmitters and receivers are normally mounted in a specially constructed pillar. The standard configuration is for each pillar to be fitted with the transmitter, sending out a cone of non-visible infra-red light, and six receivers equally placed over a height of 2.5 metres. The pillars are faced in metal, with apertures of black acrylic through which the beams are transmitted or received. Infra-red pillars are installed facing each other, and the normal operating distances between them is up to 100 metres.

When an intruder disturbs the infra-red beams, thereby causing a significant rate of change in received beam intensity, the signal processing circuits will generate an alarm. Where multiple beams are deployed in a stack or fence formation, the alarm will be delayed when only one beam is broken as opposed to the virtually immediate alarm when all beams are broken simultaneously; by this means, false alarms (induced by birds flying through the beams or the intrusion of small animals) are reduced to a minimum. However, an intruder – even if he attempts to roll through the bottom beam – will be detected. Changes of beam intensity by the onset of rain, fog or snow are automatically sensed by the processing circuits, and loss of system sensitivity is countered within the control unit. Similarly, if an attempt is made to introduce an external source of infra-red light, an alarm will be generated.

Both the CCTV and intruder alarm systems used on their own can have disadvantages: an intruder may be undetected by a camera system, while an intruder alarm system merely detects an intrusion without verifying the nature or extent of the threat. If the two systems are used together, they complement each other. As automatic intruder alarms are monitored continuously by electronic control circuits, they possess a 'long watch' capability. Even so, there are drawbacks in using a security system comprised solely of automatic intruder alarms. The cost-effectiveness of such systems can only be assessed by the user in terms of minimizing false alarms. A television camera does not give false information – even if the camera were to be 'shot out' it would tell you something!



**Right:** An example of modern security fencing with the Y-shaped upper arms designed to prevent intruders climbing over. The lower wire mesh is also very difficult to climb. This sort of fencing can be used to secure the perimeter of sensitive installations, but will not be fully effective without additional surveillance and warning devices.





The method of combining the two types of system can vary from being simple to sophisticated. A simple method would be to rely on the security guard to respond to the intruder detection alarm by selecting the relevant camera for picture display on the monitor and, in the case of remotely controlled cameras, point the camera to the area indicated and then verify the type and extent of the intrusion. A sophisticated method would be to use the intruder detection alarm to switch the relevant picture on to a picture monitor automatically, and, in the case of remotely controlled cameras, the camera would be made to point automatically to the intruded area. The detection system would have priority over a manual or sequencing switch, and the picture would be held until the alarm was reset or another alarm was signalled. Such a system meets all the requirements of a perimeter protection. It deters intruders: the sight of a television camera mounted in the open will warn intending intruders that the risk of detection is high, and this may deter them. It detects a threat: one guard using the television cameras can effectively patrol the whole area without moving from his monitor screens and, by their use, can detect any suspicious activity outside the fence. It senses an intrusion: the intruder alarm system will signal an alarm immediately an illegal attempt is made to enter the premises, and the television system will verify the nature of the threat. It locates the intruder: the intruder alarm system will give a broad indication of the area where the intrusion is taking place, and the television system will locate the exact position. It responds to and neutralizes the threat: because the guard has seen the intruder on the television, he will know how many people are involved and whether they are armed, so he can use his judgement as to whether it is sufficient to send a patrolman to chase off or apprehend the intruder or whether to call on the services of security forces. Further, he can effectively monitor the progress of his patrolman and call for extra assistance if required. So a television and intruder alarm system can perform all the functions required for a security system. And it will be appreciated that all this can be achieved with a very small staff. Having said this, no system can entirely compensate for armed guards, particularly in a developed terrorist situation.

All perimeter protection systems must include some fence or barrier to delay or impede the progress of the intruder towards his target. It is not the intention of this section to include comprehensive coverage of fencing, barriers or gates, but some examples of the more sophisticated types of gates,

fences and anti-intruder automatic road blocks are included.

Finally, when considering any system, the amount of light that is available at night must be considered. Lighting is the life-blood of television, and the amount of light available determines what type of sensor tube should be deployed. The most commonly used sensor tube is the Vidicon; for most applications, there is nothing that does the job quite so well. The Vidicon is reasonably priced, readily available and has a good life expectancy. It can be used in such a way that the camera automatically adjusts to give a constant level of picture for changes in the illumination of the scene. Using a Vidicon, the average minimum incident illumination required would be 20 lumens per square foot. This assumes an average scene, and includes a factor for deterioration of the lighting units due to age as well as occlusion from rain, dust and snow. This is, of course, higher than is used for normal security lighting, but it does have its advantages. It acts as a deterrent: intruders do not like to be seen – darkness is their best ally. Pictures can be obtained with lower levels of illumination, but they will not be of such a high quality. In some instances, installations can operate with light levels of between 1 and 5 lumens per square foot, but the pictures tend to be ill-defined. In this case the Vidicon is being made to work very hard, which will shorten its life as well as having other side effects.

For lighting levels above 1 lumen per square foot, but no higher than 5 lumens per square foot, a more sensitive tube is called for. Such a tube is the silicon diode array Vidicon. This is a more expensive tube (in the order of five times as expensive as the normal Vidicon) and cannot be operated automatically within the camera. To achieve a constant picture level output, a special type of lens is required; this in turn costs more than a conventional lens, whether zoom or fixed. By automatic electronic sampling of the picture signal, the aperture setting of the lens regulates itself using a servo motor. This process is continuous, and by using this technique the picture signal is maintained at a constant level. These lenses are usually fitted with a neutral-density filter, which, when used in conjunction with the iris, enables the camera to maintain a constant level of picture signal from dim to very bright lighting conditions.

To operate in lighting levels below 1 Lumen per square foot, a more specialized type of sensor tube is required. There are several different types available, but one thing they have in common is that they are all very expensive, and usually the cost of such a

system is not justified within the scope of normal security work. Generally, this kind of system is restricted to military applications.

If the availability of light is a problem, there are alternative solutions, one of which is to fit searchlights on the camera panning head so that the camera is always viewing an illuminated area. The 'throw length' of the light path must be taken into account, and this can restrict the effective range of the camera. An intruder would obviously know where the camera was pointing. Because of the visible light beam, this cannot be seriously considered as a primary detection system. A solution to this – and coincidentally to another problem – is the use of infra-red light. There are some sites that, for various reasons, cannot have a highly lit security area. (The reasons could be that they are in the middle of a residential area, where the local residents would object to a brightly lit premises nearby, or the site owners may not wish to advertise the existence of a security site.) Under these circumstances, use can be made of a silicon diode array

Vidicon, a version of which is highly sensitive to the infra-red content of light. For such applications a cluster of searchlights is fitted to the panning head so that they move and point where the camera points. These lights are enclosed in two special housings, one mounted on each side of the camera. The front of the housing is fitted with visible light-absorbing, or infra-red, pass filters. Thus the only light to shine through is infra-red, which is not visible to the human eye. This is termed a covert light source. The range of these lights is in the order of 200 metres, and an intruder can be illuminated and detected without knowing it. Such a system will operate satisfactorily in normal daylight, the lights only being required at night.

Clearly, perimeter protection is a large and complicated subject. One short chapter cannot possibly do it full justice. However, it is hoped that the examples in this chapter of the wide range of equipment available will serve to illustrate the scope, sophistication and complexity of the business today.

**Right:** A rising road blocker manufactured by Gate Systems Ltd of Birmingham, England. There are a number of similar systems in the following pages. The essence of the block is that the mechanism is buried in the road surface and the block can be raised to prevent entry or egress at will





**Above and above right:** The Jørgen Andersen Mobile Surveillance System mounted in a Ranger Rover.

## BELGIUM

### Advanced Devices Laboratory Intruder Detector Systems

**Multiple Head IR System Series 64:** Developed by Advanced Devices Laboratory Europe of Brussels, the Series 64 passive IR system is designed to permit the operation of five remote sensors from a single Model 6400 control unit. The system can be expanded to twenty remote sensors with the use of a 6460 control unit. A stand-by power pack provides eleven hours of continuous operation in the event of a power failure.

**Variants:** A long-range conical beam-like pattern,  $0.75\text{m} \times 20\text{m}$ , is available on the Models 6401 and 6441.

**Data:** weight of sensor unit 1.3kg; sensor dimensions  $12.7\text{cm} \times 6.4\text{cm}$ ; detection sensitivity detection of person in protection pattern moving at one foot per second or faster; area of coverage tear shape of approx.  $6\text{m} \times 6\text{m}$ .

**Multiple Head IR System Series 66XX/66XXRM:** The solid state series 66 system establishes a stable non-alarm condition from the ambient IR radiation from within the surveillance area. Should an intruder enter or

leave the surveillance area, a rapid change in the IR energy level is created. The sensors detect the change and activate the alarm circuit.

**Data:** weight of sensor unit 1.3kg; sensor dimensions  $21.3\text{cm} \times 12.7\text{cm} \times 9.6\text{cm}$ ; detection sensitivity as for Series 64; area of coverage tear shape of approx.  $10\text{m} \times 10\text{m}$ .

**Long-Range Detection System Model 4400:** This has a range of up to 100 metres and is therefore suitable for the long perimeters of major installations.

**Data:** weight of sensor unit 4.5kg; detection sensitivity capable of detecting intruder moving in protected area between 7.5mm per second and 16kph; area of coverage  $10\text{m} \times 100\text{m}$  (Antenna 3011),  $17\text{m} \times 85\text{m}$  (Antenna 3012),  $20\text{m} \times 50\text{m}$  (Antenna 3014),  $24\text{m} \times 35\text{m}$  (Antenna 3016),  $27\text{m} \times 27\text{m}$  (Antenna 3019).

**Variants:** The Advanced Devices Laboratory offer a variety of other microwave detectors each providing different areas of coverage.

**Employment:** These systems are in use in Belgium and elsewhere in Europe with various companies. Most Advanced Devices Laboratory equipments are also in wide use in the US.





## DENMARK

### Jørgen Andersen Ingeniørfirma Surveillance Systems

The Jørgen Andersen Mobile Surveillance System consists of a British Leyland Range Rover fitted out for TV surveillance with JAI 700 series low light level cameras. The camera is mounted on a motorized pan-and-tilt unit on top of a three-metre motor-driven hydraulic mast. Four hydraulic supports stabilize the vehicle while the camera is in operation. The camera unit and mast are retracted through a 'sunshine' roof to a position inside the vehicle.

**Variants:** The 730 SIT has been superseded by the JAI Nighthawk low light level camera series, the JAI 733 SIT (moonlight), the JAI 743 ISIT (starlight) and the JAI 736 gated SIT. These cameras can be used from full daylight down to illumination levels at which the human eye will see nothing. The 736 can be used in continuous mode, or the tube intensifier can be used as an electronic gate to reduce the exposure time to as little as 1/100,000 of a second, thus providing excellent material for identification purposes. JAI also

produces a special surveillance system. The JAI Emergency Surveillance Kit (ESK) consists of a fully equipped LLL TV camera with all necessary power supplies and supporting equipment. In addition, a 10× motorized auto-iris zoom, a 25mm fixed focal lens and a number of special lenses are included; all of this is contained in two solid trunks.

**Employment:** Security organizations in Denmark, Norway, Germany and UK.

**Data:** JAI 730 SIT camera *dimensions* 12cm × 13cm × 44cm; *weight* 5.5kg.

## GERMAN FEDERAL REPUBLIC

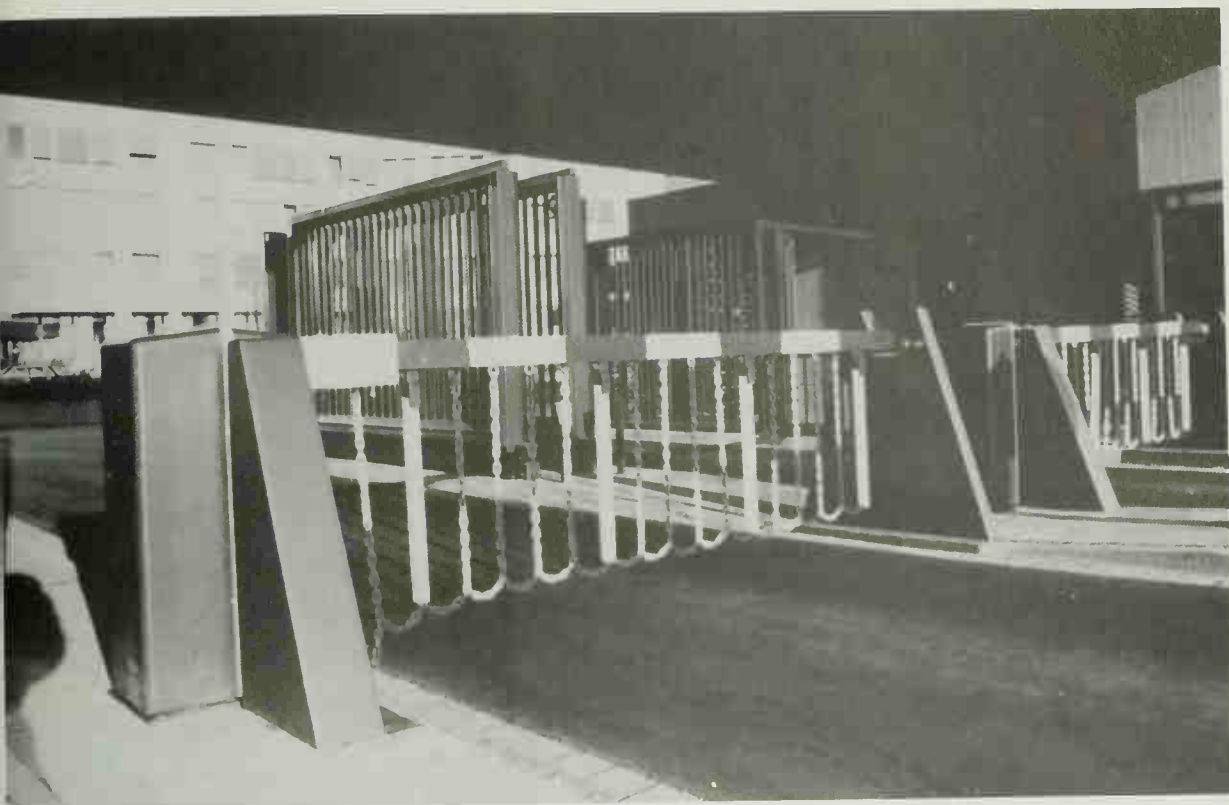
### Elkosta Perimeter Protection Equipment

Elkosta, of Salzgitter, produce gates, railings, barriers, turnstiles, road blocks and fencing.

**Gates:** Elkosta produce a variety of gates to aid security. These include sliding gates, telescopic sliding gates, hinged gates, centrally pivoted gates and lowering gates. They can be operated manually or by electro-mechanical or electro-hydraulic drive units. All Elkosta gates are manufactured from high quality steel







Various perimeter security barriers and gates from Elkosta of Germany.

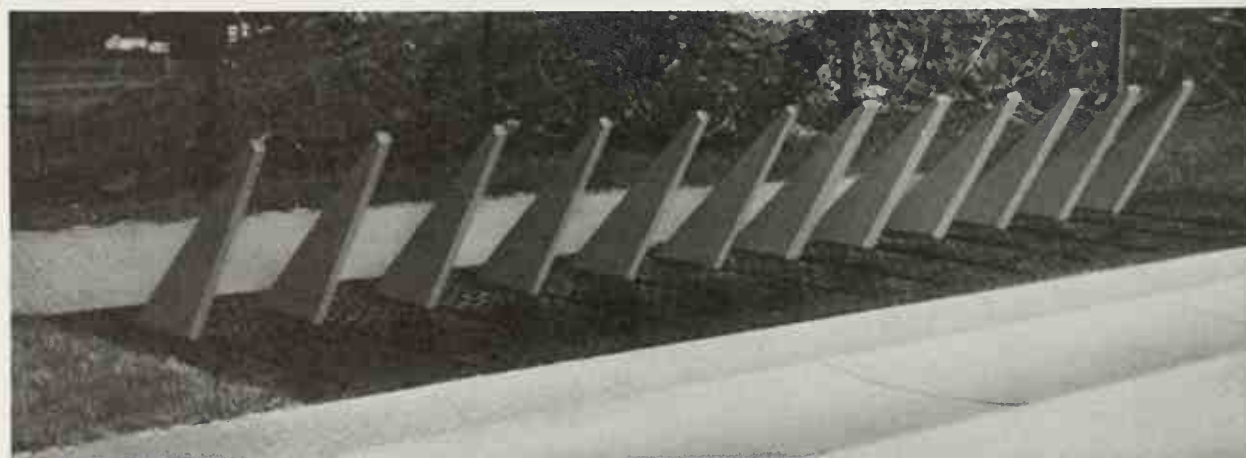
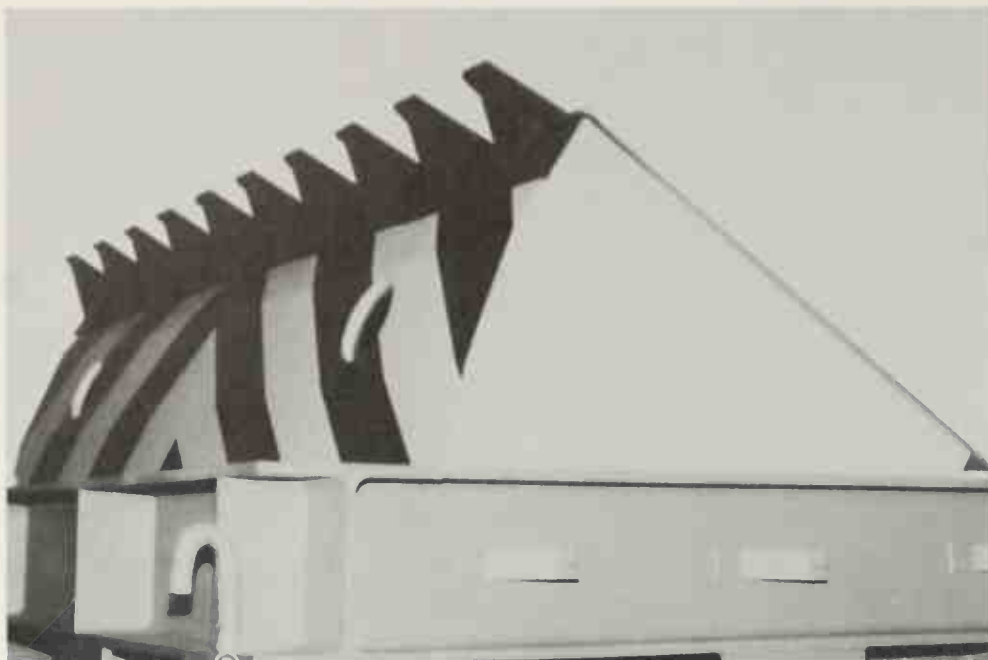
**Above left:** A robust sliding gate designed to withstand impact from vehicles.

**Left:** Vertical-lift barrier gates.

**Above:** Standard dropped barrier, a conventional gate with additional hanging chain attachments designed to provide a more solid visual aspect to a relatively lightweight system.

**Right:** Turnstyle-type controlled entry points with remotely controlled stop/go lights.







**Above left and left:** Three of the Elkosta range of road blocks.

**Above and above right:** Israeli Hish Watch Towers. From left to right, they are 100, 200 and 300 Series respectively.

and are galvanized and plastic coated. Whatever the type of gate installed, they are all immensely strong and can be opened or shut quickly. They are, therefore, designed with security in mind.

**Entrance Barriers and Road Blocks:** Elkosta manufacture conventional entrance barriers, some of which are lowered, and others that rise into position from underground housing. Where it may be necessary to guarantee preventing vehicle access or egress, electro-hydraulic or electro-mechanical road blocks with a resistance to impact of in excess of 120KN are ideal. Visible and acoustic safety equipment signal the movement of the barrier out of the road and into a blocking position.

**Turnstiles, Railings and Fencing:** Turnstiles incorporating a coded access system, palisade and welded mesh fences are available.

**Variants:** The 100 Series are for use in battle areas or within range of heavy fire. They are ideal for installations needing tight security and border areas. The 200 Series are round watch-towers primarily for use in less sensitive installations. The 300 Series are more suitable for industrial installations needing some form of security.

**Employment:** Israeli armed forces.

### **Yael-5 Fence Intrusion Detection System**

Developed by the Yael Electrical Instruments and Control Company of Beersheba, this system is based on differential force sensors. The system will detect an attempt by an intruder to climb the fence, cut the trip wires or the control cables, crawl under the fence or attempt to interfere with the wires in any way. It can be installed on any type of existing fence, including concertina barbed wire. An average of 100 to 120 units per kilometre of fence are required.

**Variants:** Yael-7 automatic ambush system, designed for field use, detects personnel crossing a pre-determined line up to 100m long. The system emits an alarm and may be set for manual or automatic triggering of arms, explosives and anti-personnel mines. The 1.9kg control box of the Yael-7 can be used alternatively as a manual all-purpose explosive triggering unit for up to four charges set off separately or simultaneously.

**Employment:** Israeli Army.

## **ISRAEL**

### **Hish Watch and Guard Towers**

The Hish Steel Works of Haifa Bay have developed a series of guard and watch towers for use along borders and for guarding installations. The towers vary in height from 6m to 6.6m, and attachments vary according to the environment in which the equipment is expected to operate. The towers have been used in operational conditions in Israel.





**Above:** The Chubb 8700 Access Control System.

**Above right:** A detail of the connecting wire on the Euro-Med Perim-Alert low voltage sensor system for perimeter fences.



## THE NETHERLANDS

### Chubb Access Control System 8700-ES

The system consists of a keyboard, VDU, printer, bubble memory and card reader. It is capable of handling 4,500 encoded ID cards with up to 64 individual card readers. Card-plus-code readers are for situations where a greater degree of security is required; in this instance a coded card and knowledge of a press-button code is required to gain entry.

### Euro-Med Perim-Alert Perimeter Protection System

Euro-Med Bv manufacture the Perim-Alert system under licence from the Norton Company of the USA. The system is a low voltage system which uses fence-mounted sensors to detect vibration resulting from any interference with the fence. Any vibration will break the closed contact of the nearest sensors, which are normally placed on every third fence post. Variable set-ups for the sensors and CAM (Computerized Alert Monitor) allow an individual section to be adjusted for sensitivity to compensate for local fence or environmental conditions. The system has a remarkably low false-alarm rate. The CAM610 can accommodate 6-10 channels and the CAM102, 1-2 channels.

**Employment:** IBM, Exxon and Dupont Installations in the USA, Chrysler-Simca in The

Netherlands, Colgate-Palmolive GmbH in West Germany, The National Iranian Gas Company in Iran. Perim-Alert has also been chosen as the primary fence-mounted alarm system to be used in the current NATO nuclear site security improvement programme.

**Data:** *dimensions* 6cm × 4.7cm × 3.8cm (sensor), 48.9cm × 15.2cm × 31.7cm (CAM 610), 25.4cm × 15.2cm × 31cm (CAM 102); *weights* 1.7kg (sensor), 12.3kg (CAM 610), 5.7kg (CAM 102); *range* 8km (line length).

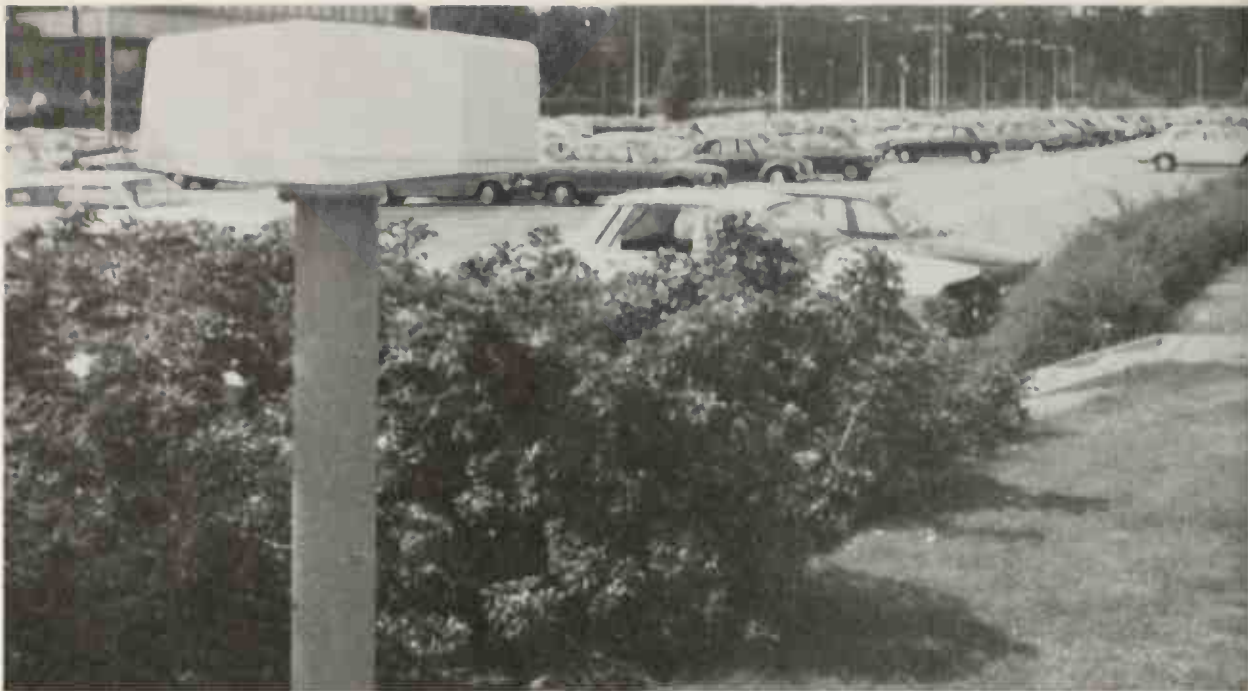
### Philips Surveillance and Detection Systems

**Electronic Security Systems:** Philips are very much in the business of designing systems for particular needs. (They are by no means the only company to do this; indeed many companies in the USA, UK and Europe provide similar systems.) Philips first draw up a threat analysis, then define the requirement, taking into account existing security arrangements or limitations, and arrive at a plan for the installation in question. They then install the system, train the personnel who will operate it, and service and maintain the equipment. Integrated systems could include perimeter fencing and lighting, special fences and gates, toughened glass, shutters for windows and doors, special doors, CCTV systems for remote observation and surveillance, threat detection systems and electronic access con-

**Right:** Philips CCTV perimeter surveillance equipment.

**Below:** The control room for the Philips system, which features CCTV, voice logging and public address. This is typical of many control centres marketed by security companies. By controlling large perimeters from one central point there are clearly considerable savings on manpower and optimum overall co-ordination.





**Above:** The Philips Microwave Fence LH1130. The 'fence' itself is, of course, invisible as it exists as a continuous microwave beam which, when broken, will activate a warning alarm or indicator; the equipment illustrated is one of the transmitter/receiver units, which can be placed up to 300m apart.

**Above far right:** Another invisible fence; this is a transmitter/receiver for the Ericsson Telematerial Radar Barrier.

control systems. The integrated system is controlled from a security control centre.

**CCTV Remote Observation and Surveillance:** Philips produce an extensive range of cameras. The Video 40 system has indoor and outdoor camera versions, can operate in temperatures from  $-10^{\circ}\text{C}$  to  $50^{\circ}\text{C}$  and, with Newvicon tubes, can operate in light levels from 100,000 lux to 0.4 lux. Resolution is, with Vidicon, better than 500 TV lines and, with Newvicon, better than 550 TV lines. Video 50 is a more sophisticated system that includes a range of camera heads; Video 50 Starlight Cameras feature built-in image intensifiers and make conventional lighting unnecessary.

**Slow Rate Video Transmission System (SRTV):** Provides an efficient way of detecting threats, and maintaining effective observation and surveillance facilities, in remote locations. In places where it would normally be uneconomic or physically impossible to install normal video cabling, an SRTV system enables good quality pictures to be relayed from up to four cameras using low-cost speech-grade communication lines or the public telephone network. Linked to a threat detection system, it provides an exceptionally effective means of checking and verifying alarm causes at a central control.

**Microwave Fence LHD1130:** This fence has been developed by Philips for use in all types of weather, including heavy rain, snow and

dense fog. The system can be adjusted to differentiate between human beings and other moving objects such as birds and small animals. Ideally a microwave system such as this should be used in conjunction with CCTV cameras. In this way, intruders can be detected and their precise location and movements established and observed.

**Employment:** Various installations in The Netherlands.

**Data:** transmitter/receiver dimensions  $45\text{cm} \times 17.5\text{cm} \times 17.5\text{cm}$ ; weight 10.5kg (transmitter), 11kg (receiver); range 30m–300m; beam height fixed at approx. 3m; beam width variable.

## SWEDEN

### Ericsson Telematerial Radar Barrier KEK11001

The Ericsson KEK11001 Radar Barrier is designed as a perimeter protection system or for use along frontiers. The radar barrier is a bistatic radar consisting of a transmitter and receiver. These are installed 300 metres apart and are aimed at each other. The units are mounted on a 60cm tubular post. The  $11^{\circ} \times 11^{\circ}$  lobe angle can be modified for  $11^{\circ} \times 18^{\circ}$  or  $18^{\circ} \times 18^{\circ}$ , but this reduces the range by 60% and 84% respectively. By erecting strong wire netting or a perforated metal sheet at the





**Above:** The Riwosa Mini Spy Detector, a portable system or 'debugging' a room or area. Note that it is possible to use this system employing mains electricity if required, via a transformer.

deviation points of the perimeter, the signal lobe can be made to reflect around corners. The height of the radar lobe is particularly impressive: approximately that of a 3-storey building. Sensors are capable of operation in all weather conditions, can discriminate between human beings and small animals or birds and is tamper proof. Ericsson also manufacture alarm communication systems to manage alarm systems.

**Data:** sensor dimensions 25cm × 28.7cm × 30cm; sensor weight 3.5kg; range 300m; lobe angle 11° × 11°.

## Securitas Security Systems

Securitas of Stockholm, Sweden, provide integrated security systems. The Securitas Sector Station concept provides a completely integrated security system. As well as designing systems and providing equipment, Securitas provide training packages and other more traditional forms of security such as guard dogs.

**Access Control:** Securitas market the Philips Electronic Access Control System. This system uses a magnetically encoded key which is inserted into a key reader. This reader can be adapted to offer even higher levels of security by the addition of a small numeric keyboard into which personal identification numbers may be inserted. A security access controller affords control of 128 doors.

**Code Readers:** A security guard equipped with hand held bar-code readers can do his rounds and scan self-adhesive bar-coded labels placed at strategic points around an installation along a pre-planned route. By scanning each label, the guard captures all the necessary information – its location, the time of registration, the number of visits and so on. Up to 1,500 bar-code readings can be stored in the memory. Consequently, guards do not have to write reports; in effect they have a tachometer.

## SWITZERLAND

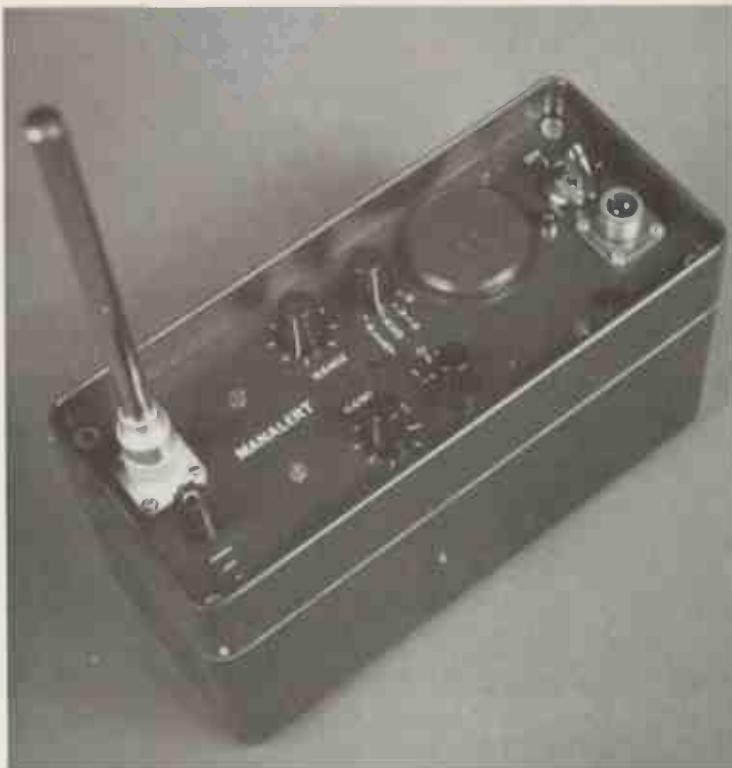
### Riwosa Security Equipment

**Mini Spy Detector:** A portable electronic eavesdropping equipment detector, this consists of a transformer and circuit connected to a low frequency generator and a frequency scanning receiver. It allows security services to ensure that a room or vicinity is free of eavesdropping equipment or 'bugs'.

**Data:** frequency range 8–20MHz (scanning time 8 seconds), 6–1000MHz (scanning time 150 seconds); temperature range 0°C to 35°C; operating time 6–8 hours; battery charger 220V; dimensions 42cm × 31cm × 8cm; weight 8kg.

**Quick Alarm:** This system enables security guards, policemen, or personnel of the armed forces to transmit a call for help invisibly to a central alarm centre. A switch-on insert located in the shoe enables the wearer to activate the emitter. The switch-on system is so designed as to permit its use with practically any type of 'walkie-talkie'. Not only is the alarm centre alerted, but all conversations are also transmitted, thus revealing the extent of the emergency.





**Variants:** For the security of particularly vulnerable personnel, a miniaturized emitter (rather than the 'walkie-talkie') can be attached by a suspender or wire holder to the individual to be protected.

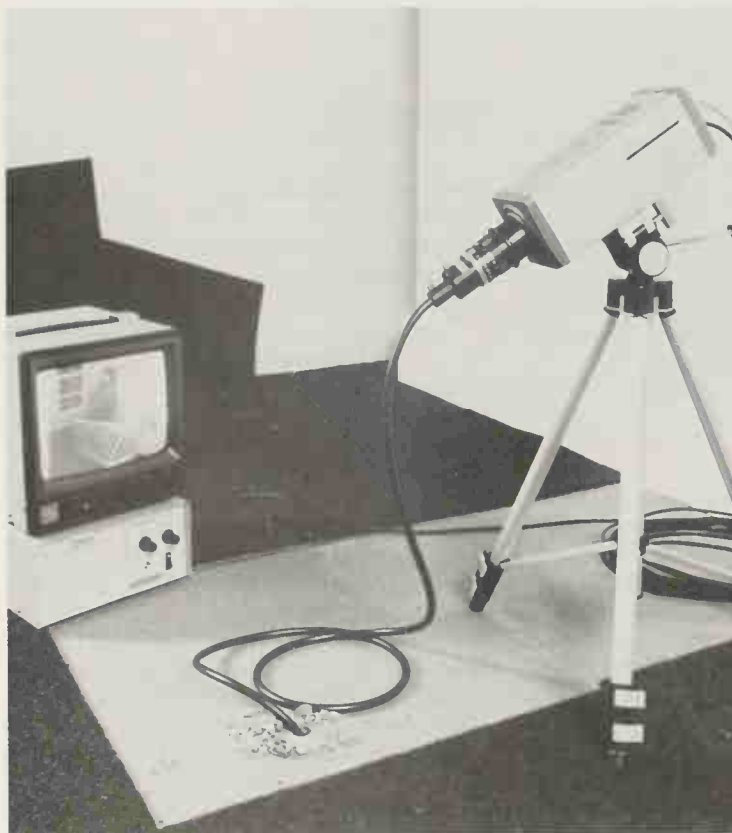
## UNITED KINGDOM

### AD Industrial Electronics Manalart Portable Detection System

The Manalart system, developed by AD Industrial Electronics of Edenbridge, is a portable detection system. The unit is placed in the centre of the space to be protected, and the telescopic sensor is raised to a suitable height, which in conjunction with the range control sets the range at which a person's presence can be detected. A spherical detection area is then established surrounding the sensor. The sensor can be located remotely from an alarm system and can operate for more than two weeks continuously on internal batteries.

**Employment:** Several police forces in the UK and the armies of some Middle Eastern countries.

**Data:** case length 23cm; case depth 10cm; case height 14cm; weight 4.4kg.



**Top left:** AD Industrial's Manalert Portable Detection unit.

**Below left:** The Allen RS-445 Fibre Optic Surveillance Set. In this illustration, the operator has mounted a surveillance of the landing in a house below the room in which he is situated. The monitor provides a clear but clandestine view of anybody entering or leaving the building; this can, of course, also be recorded.

**Left, right and below:** The Barr & Stroud IR18 Mk II Thermal Imager.



### **P.W. Allen Fibre Optic Surveillance Set RS-445**

The purpose of the set is to aid covert surveillance, particularly when using CCTV, by putting between the observer/camera and the final objective lens a fibre optic image guide (or 'coherent bundle'). Thus, the camera need no longer be adjacent to the final 'point of viewing', where often due to space limitations, etc., it is neither possible nor desirable. An eyepiece is included for initial setting up or when CCTV is not required. Four lenses with angles of view from 6° to 60° are supplied, including one with a 60° field of view with a taper nose and requiring only a 1.5mm diameter 'hole'.

**Employment:** This equipment has now been well proven in field conditions with many British police forces and the British Army.

**Data:** *magnification* ×8; *fields of view* four lenses with angles of view from 6° to 60°; *weight* 3kg; *dimensions* 46cm × 33cm × 11.4cm.

### **Barr & Stroud Thermal Imaging System IR18**

Thermal Imaging is the conversion of radiated or reflected heat into a real-time picture: a thermal image is thus a pictorial representation of temperature differences. The IR18 is the result of twenty years experience in the IR field and has been fitted in armoured vehicles, fixed wing aircraft, helicopters, ships and submarine periscopes. Its uses in security and surveillance tasks are widespread, for the small size and high sensitivity of IR18 make it an effective instrument for a variety of police and security applications. For short-range tasks, considerable detail can be obtained, including features that are not apparent to the eye under any conditions. Its ability to 'see' into shadow and past floodlights enables the operator to observe targets that are under arches, in doorways or open windows, under floodlit or blacked-out vehicles or aircraft or hidden by light foliage.

**Data:** *field of view* 38° × 25.5°; *resolution* 1.73mrad; *pupil diameter* 14.5mm; *detector* Mullard Sprite; *spectral band width* 8–13μm; *display* 625/525 lines/frame; *power supply* 24V DC; *power consumption* 34W at 24V; *total weight of scanner* 7.4kg.

### **British Aerospace Steadyscope Monocular GS 907**

A hand-held gyrostabilized viewing device intended to avoid the blurring of images while moving at speed in boats, vehicles and aircraft. Offering magnifications of ×10 and ×7,



it features an internal steering device. The  $\times 7$  magnification unit can be augmented with a night vision image intensifier. Weights are 2kg (day unit) or 2.4kg (night unit). Dimensions are 251mm  $\times$  225mm  $\times$  96mm (day) and 270mm  $\times$  225mm  $\times$  96mm (night).

Variant: Steadyscope Binocular GS 982 incorporates a similar mechanism and weighs 2.3kg.

### **Chubb Vigilante Perimeter Protection System**

Movement creates vibrations, and any form of human movement can be detected by a geophone. With a little practice, those responsible at a central control point can quickly learn to detect individual footsteps, whether walking or running, and also dragging of heavy objects over an area of ground in which geophones have been emplaced. To detect such vibrations, the Chubb Vigilante System utilizes geophones in a very similar manner to the way in which they are used in geophysical survey work and in detecting seismic tremors, either natural or man-made. The signals are transmitted via special cables to an intermediary channel unit. In this unit are fitted special filtering devices designed to eliminate piratical vibrations such as might be caused by the operation of heavy machinery, etc. The control room contains a visual display of the entire perimeter with indicator lights to show where the system has been actuated; each circuit has a visual neon display showing the vibrations as they are received and a loud-speaker that reproduces these audibly. One man can supervise a mile of perimeter day and night, under all weather conditions. The system can also automatically switch on floodlights and closed-circuit television. Vulnerable installations can be supervised from a control several miles away, and in the event of an alarm condition immediate surveillance can be made from the control by closed circuit television. Geophones can either be installed approximately 0.33m underground or on most standard forms of fencing or walls. They can also be placed in the ground on one or both sides of the fence, thereby giving warning of approach as well as penetration of a fence.

**Employment:** This system is currently employed at Stonehenge.

### **Civil Defence Supply Dragon Portable Searchlight Mk 2**

Claimed as the most powerful cordless searchlight in the world, Dragon is capable of illuminating areas at ranges in excess of 800m. The 100-watt aviation-specification element is



**Left:** An interesting illustration of the Barr & Stroud IR18 Thermal Imager in a military context, in association with a NOD 'A' passive long-range sight. (See page 203.)

**Below left:** The Steadyscope binocular GS 982.

**Top right:** The Dragon portable Searchlight, here worn with a shoulder strap that leaves the user's hands free; the searchlight can be directed on target by simply moving the body.

**Centre and below right:** A Land Rover mounted version of the Claribel Hostile Fire Indicator. The display unit indicates the direction from which a weapon has been fired, by means of an arrow on the dial. Four radar heads are mounted on the exterior of the vehicle, one of which can be seen in the lower illustration.

housed in a shock- and water-resistant PVC casing. It is rechargeable up to 2,000 times or can be powered by any 12V vehicle. Carrying straps afford hands-free operation, using body movement to aim the light. Accessories include tripod adaptors, remote control devices, a mains charger, high speed chargers and a supplementary battery pack originally designed for EOD teams that doubles running time.

**Variants:** Infra-red Dragon is used to enhance image-intensifiers, giving up to three times increase in gain.

**Employment:** United Kingdom (virtually all police forces) and other police forces, law enforcement and security agencies worldwide.

**Data:** length 38cm; case diameter 10cm; head diameter 15.25cm; weight 3.75kg (with battery); light output 250,000CP (46 minutes duration), 180,000CP (80 minutes duration); battery type Ni-Cad; charge time 10-12 hours.

### Claribel Hostile Fire Indicator

Developed for the British Army as a means of determining the source of fire aimed at patrols or observation posts, Claribel is a low powered X-band CW radar system. It provides 360° coverage in all weathers and picks up missiles of all velocities except stones, bricks, etc. Comprising four radar heads, commander's and crew's displays, central processor unit, orientation unit and power supply, the equipment can be fitted in Land Rovers, APCs or even saloon cars, in the last case invisibly located in the bodywork. After the tracking data has been processed, the direction of fire is indicated on a simple, electro-luminescent clockface display. This visual warning is supplemented by an audible alarm. The system will indicate the positions of two separate snipers firing simultaneously. Should the vehicle driver take evasive action, the in-built orientation system correspondingly updates the information display. Powered by lead/acid batteries, the Claribel system can operate for eight hours between charges.

**Variants:** A man-portable variant known as Aries houses the radar heads in a specially design flak jacket; the processor unit is carried in a pouch on the belt and the display on a watchface at the wrist.

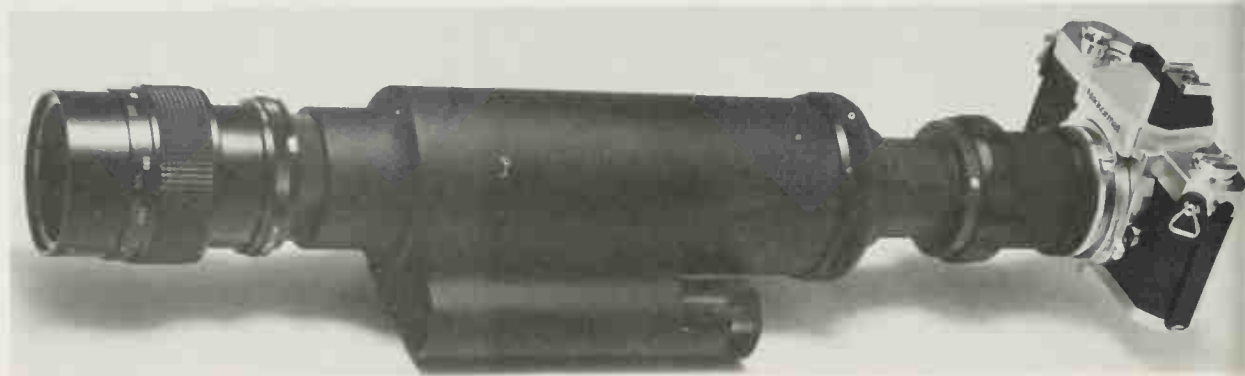
### Davin Optical Night Vision Equipment

Davin Optical Ltd. of Potters Bar, Hertfordshire, manufacture a range of optical products including night vision systems.

**Hand Held Viewers and Night Rifle Sights:** Davin Optical produce a family of hand held







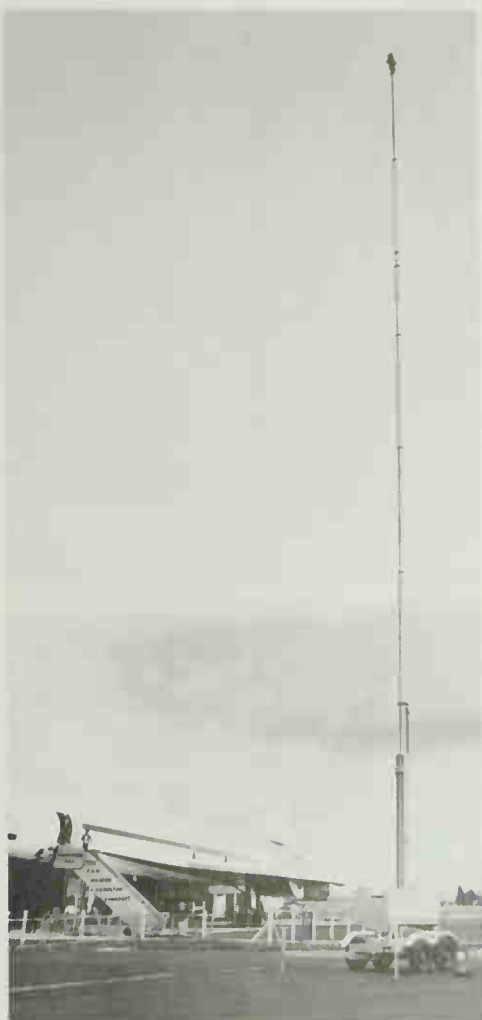
**Top left:** Davin Optical's Spylux Personal Night Scope.

**Left:** A Hi-Spy camera.

**Right:** Hi-Spy up and running at the Fleet Air Arm Museum in Yeovil, Somerset.

**Centre left:** One of the Modulux 125 Night Vision devices, here attached to a 35mm SLR camera.

**Bottom left:** Maxilux, a combination of telephoto lens and image intensifier, permits long-range photography at night.



viewers and night rifle sights based on the same modules. They are the IRS 218 Low Profile High Performance Night Rifle Sight, the MH 218 Dual Role Lightweight Military Viewer and the SH 218 Hand Held Viewer for General Security use. The IRS 218 is 204mm long  $\times$  63mm in diameter, weighs 1.1kg, has a magnification of  $\times$  2.8 and a field of view of  $14.6^\circ$ . The gain is  $\times$  50,000. The IRS is designed to exploit fully the latest second and third generation image intensifier tubes and is fully sealed and ruggedized to meet all military requirements. The MH 218 is designed to fulfil a dual military role: firstly, as a fully sealed compact pocketscope for night time observation, and secondly as a robust lightweight rifle sight. The SH 18 hand held viewer has been designed to accept standard C-mount lenses.

**Spylux Personal Night Scope:** The Spylux has been designed to satisfy the needs of the

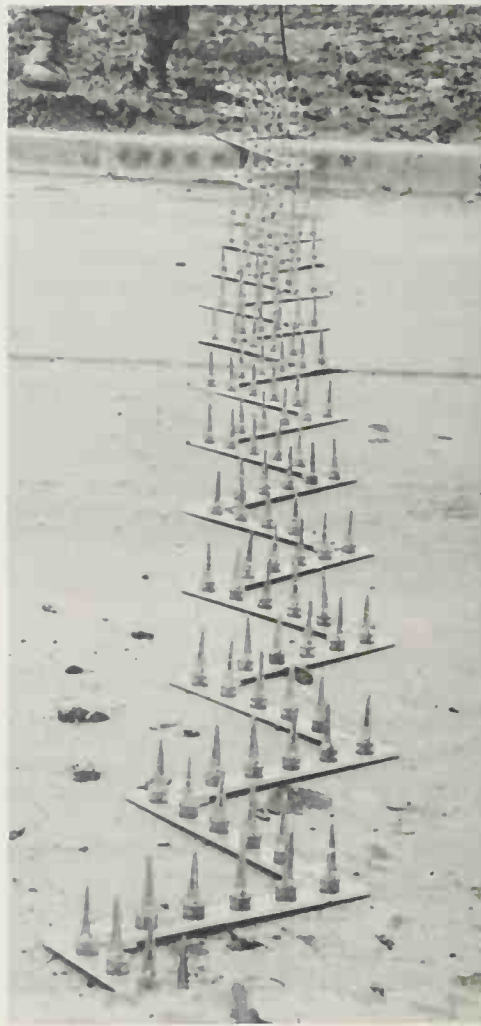
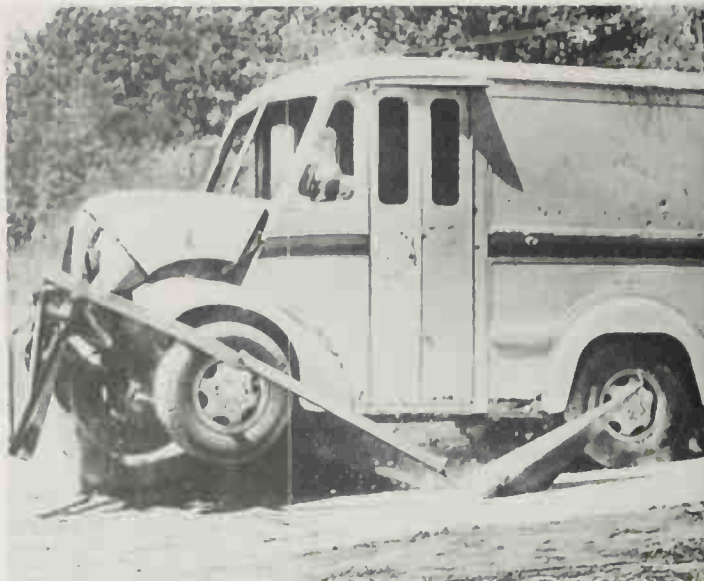
police and security forces for an inexpensive but effective night viewer. To meet these requirements, Spylux is rugged and compact, giving a high contrast, good resolution image at low light levels. It incorporates such features as a focusing eyepiece, finger operated, fully sealed, push-button on/off switch, and C-mount lens adaptor. The Spylux weighs about 0.6kg and operates from readily available AA size batteries. It can be supplied with F1.4, 75mm focal length lens, to give a magnification of  $\times$  25. Lens converters for  $\times$  1.5 and  $\times$  2.0 are also available.

**Modulux 1st & 2nd Generation Night Vision Equipment:** Modulux comprises a set of rugged, compatible modules that can be assembled and installed into a wide range of systems to give the best configuration for any given set of circumstances. The system permits users to view and/or record images that have been amplified by a factor of at least 100,000 times. The system is totally compatible with most popular commercially available SLR cameras and lenses. Modulux can operate in any one of three modes: observation, photography or CCTV. Clearly, the system is ideal for intelligence gathering, border patrols, perimeter surveillance and riot control.

**Maxilux M:** The primary purpose of Maxilux M is long-range target acquisition and recognition in conditions down to starlight level. Easily portable by one man, the unit is fully sealed and ruggedized for field use. A single battery gives approximately fifty hours of operation under average low-light conditions. The high gain image-intensifier tube incorporates an automatic brightness control, and a shuttered eye cup is fitted to minimize the chance of user detection. Maxilux M is provided with a lens hood and an aperture stop as standard. The support bar has built-in tripod fittings.

### Hi-Spy Surveillance Systems 4020 and 7090

Hi-Spy Systems of Yeovil have developed two surveillance systems designed to raise cameras to heights sufficient to provide a commanding view of a rural or urban area, an airfield, vehicle park or any other sensitive location. The mast is raised by compressed air: in the case of the 4020 system this is provided by a compressor pack powered from a 12V car battery; and in the case of the 7090 system by a trailer mounted compressor unit driven by a 4-stroke petrol engine. Different pneumatic masts can be mounted within the power pack permitting greater heights to be attained (in







**Top far left:** Citadel Barbed Tape. This is unclipped long barbed tape (CBTCS4L) used in conjunction with single strand short barbed tape (CBTWS).

**Top centre:** Citadel's vicious-looking Truck Stop road block in action. The pointed impalers rise to a height of 60cm from the road surface. This is a passive system: the impalers are constantly armed by compression springs.

**Below far left:** The Lasergage LWS 1060 Lightweight Night Sight mounted on the new British Army SA80 rifle.

**Above:** Lasergage's LT 1065 Hand-Held Thermal Imager.

**Left:** The Londesborough Lazy Tongs portable road block device deployed – simple, but impassable by wheeled vehicles.

the case of the 7090 system up to 30.48m), and top guys are available to enable the system to be used in wind speeds up to 98kph. The systems are particularly suitable for monitoring crowds, and could also be used for bomb disposal purposes where devices are situated in inaccessible locations.

**Employment:** Department C7 of London's Metropolitan Police have taken delivery of one system; others are believed to have been sold overseas.

**Data:** *maximum height of camera* 12.8m (4020), 22.25m (7090); *maximum height* (30° from vertical) 7.6m (4020); *maximum headload weight* 9kg (4020), 41kg (7090); *maximum sectional area of headload* 9,290mm<sup>2</sup> (4020), 15,000mm<sup>2</sup> (7090); *camera pan* ±360° (4020), ±340° (7090); *camera tilt* ±90°.

## International Security Services Perimeter Protection Equipment

**Citadel Barbed Tape:** Unlike barbed wire, which consists of twisted wire interwoven with single pointed barbs, barbed tape has a sharp-edged strip of extruded steel diestamped into razor-like barbs at 25mm to 100mm intervals. Hand-holds are thus denied the intruder. There are two types: Barbed Tape Concertina, where the tape is around a high tensile steel core; and Barbed tape Obstacle, which is manufactured without the core. The former is intended for permanent sites; the latter as a reuseable riot control barrier. ISS also make the Citadel Instant Barrier, a helical, long barbed tape concertina joined by lengths of high tensile wire housed in an aluminium container for speedy deployment and recovery.

This makes 30m of 1015mm diameter obstruction. Citadel Rota-Barb is a 'cheval de frise' rotary-mounted tape system. ISS also supply security doors, complete fencing systems and vehicle barriers, including Citadel Auto Stop and Truck Stop, which are surface mounted 'sleeping policemen' type flip-up obstructions intended to impale an intruding vehicle.

## Lasergage Hand Held Thermal Imaging System

This is compact, self-contained, lightweight and easy to operate. It is a highly sensitive infra-red detection instrument, which converts the infra-red radiations of the scene being surveyed into a visible image viewed through a monocular eyepiece. The operational sensitivity of the LT1065 is designed to indicate to the operator temperature differences of less than 1°C. Being environmentally protected, it can be used with ease in virtually any situation and held in any attitude. It does not require any form of incidental light and will 'see' through smoke, dust, mist, haze and moderate undergrowth. Its performance is not affected by the glare of such bright lights as vehicle headlamps. High performance is achieved without the necessity for external cooling methods (such as liquid nitrogen or pressurised gases) since the detectors are thermo-electrically cooled. The power source is a small portable battery pack capable of housing disposable manganese alkaline cells or rechargeable nickel-cadmium or sealed lead/acid cells. A TV camera or SLR camera interface is available to assist in obtaining visual records.

**Data:** *spectral waveband* 3–5 microns; *field of view* 21°, 16° elevation; *magnification* ×0.75; *dimensions* 26.5cm × 16.5cm × 16.5cm.

**Variant:** The Lasergage Night Sight LWS 1060 accepts second and third generation image intensifiers and fits most weapons (SLR, FN, G3, M-16, AK-47). It can identify and facilitate a hit on a man-sized target at 300m in low light conditions.

**Data:** *magnification* ×3.5; *field of view* 8°; *focus range* 25m to infinity; *weight* 0.9kg; *diameter* 75mm; *length* 265mm.

## Londesborough Portable Road Blocks

A series of portable and permanent road blocks are manufactured, including Lazy Tongs, a lattice arrangement supporting 170 detachable, sharp, hollow-finned spikes, which will penetrate a vehicle's tyres. Each unit extends to 6.4m from a case size of 445mm × 584mm × 92mm, and weighs 17.1kg.





**Above:** The Marconi Elliott IR Surveillance System. Seen here is the V327 camera with an infra-red searchlight mounted above it.

**Above right:** Pilkington's Kite Individual Weapon Sight mounted on a GPMG.



**Variants:** A portable road block kit includes ten units that can be laid out to provide coverage of 14.9m; permanent road blocks are also available, consisting of bolt-on modules that are buried in the road. Spikes emerge fitted to rotating shafts when in operation. There is also a Lazy Tongs motorcycle version and a heavy duty version with larger, spiral spikes to penetrate heavy duty tyres.  
**Employment:** British Army.

### **Marconi Elliott IR TV Surveillance System**

Marconi Elliott has developed a night security system utilizing an IR sensitive silicon diode array target vidicon sensor tube fitted to a V327 camera, which itself is mounted between a pair of IR searchlights. The system enables an operator, situated in a control room up to 200m from the camera, to observe covertly

intruders crossing borders or security installations. Other searchlight/camera combinations are available.

**Employment:** United Kingdom and many other countries including those in the Middle East.

### **Pilkington Passive Night Vision Devices**

Pilkington Electro Optical Systems of St Asaph in Clwyd, Wales, manufacture a range of passive night vision devices, all of which have a positive internal security role.

**Kite Individual Weapon Sight:** Kite is made of a lightweight but highly robust material and weighs just 1kg. The highly advanced optics afford a magnification of  $\times 4$  and a  $9^\circ$  field of view. The refractive lens system incorporates an injected graticule to assist with accurate weapon aiming, and the system is configured to accept either second or third generation



**Above:** The Pilkington Pocketscope, a passive device incorporating an 18mm microchannel plate intensifier tube. It operates in a wide range of light conditions, so it is very effective in urban situations. It weighs only 0.8kg and is in service with the British Army.

**Above right:** Pilkington's laser Target Indicator on an Armalite M16 rifle. The soldier seen here is also using Nova General Purpose Night Vision Goggles.

tubes. The micro-channel plate image-intensifier affords a good contrast image, particularly at low light levels, and will localize bright sources of light such as muzzle flash or flares. The range of the system is 600m for a man-sized target. Kite is simple to operate: controls are a rotary on/off switch with graticule brightness adjustment and focusing controls. The modular design permits speedy sub-unit replacement and easy access to the battery compartment.

**Employment:** Kite is in production for the British Ministry of Defence and overseas armed forces.

**Laser Target Indicator:** Operating at a wavelength of 820nm, the target indicator is adapted to interface with a wide range of in-service weapons and is capable of marking a target at ranges up to 500m. The infra-red spot is viewed through an image-intensifier

system, and cannot be detected by the naked eye. The target indicator permits accurate firing without the need for lengthy weapon aiming and sight focusing. Powered by three commercially available AA batteries, the equipment weighs only 340g and greatly enhances infantry night combat capability.

**Eagle Long Range Hand Held Night Vision Device:** Eagle is a new lightweight, long range passive night device. Eagle features a catadioptric lens configuration and houses a second generation, micro channel plate image-intensifier tube, which affords very high gain within tight constraints of dimension and weight. The equipment weighs under 4kg yet offers the range capability of first generation systems weighing over 20kg. The system can recognize a man-sized target at 500m in starlight  $10^{-3}$  lux conditions. The system is completely passive (undetectable) and



security eyepads on the binocular eyepiece prevent any stray light from illuminating the user's face. The eyepiece allows simultaneous bioptic viewing, thus providing a large degree of user comfort.

**Employment:** Eagle has been sold to several customers worldwide.

**Nova General-Purpose Night Vision Goggles:**

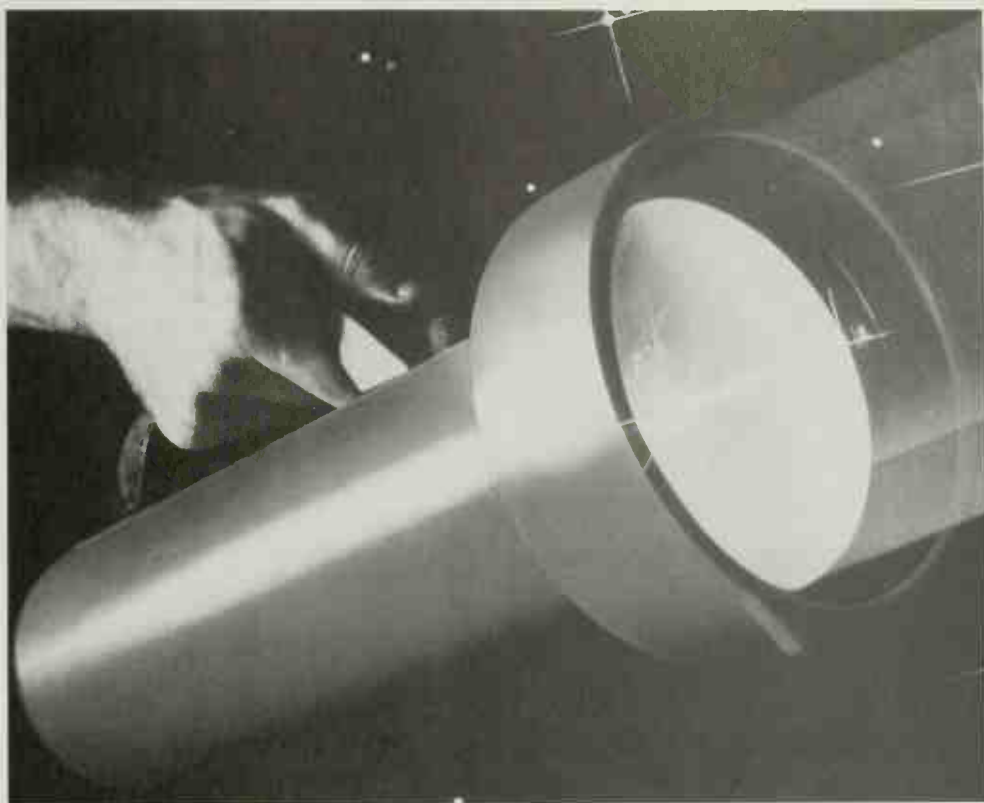
Nova is a head-mounted, passive general-purpose goggle. Incorporating the latest technology in electro-optics, it features a single image-intensifier tube for cost effectiveness and reduced weight, plus a binocular eye configuration to provide user comfort. The goggle can be hand held in conventional style or mounted on a head harness to leave both hands free for other tasks. The equipment is ideal for a number of duties such as patrolling, surveillance, vehicle driving and weapon aiming (when used in conjunction with a Pilkington P.E. laser target marker). Tasks such as map reading and vehicle maintenance are facilitated as Nova is able to focus down to 300mm, and an integral infra-red diode provides extra illumination to assist in the performance of close-order tasks. At longer ranges Nova is capable of recognizing a man-sized target at up to 300m under starlight  $10^{-3}$  lux conditions. Nova is simple to operate, having



**Left:** Pilkington Nova. The SA80 rifle in the foreground also carries a SUSAT sight; the rifles in the background are fitted with image intensifier sights.

**Below left:** Pilkington NOD 'A' Night Observation Device.

**Right:** The Pathfinder Portable Searchlight. In addition to its portable use, it can be powered from a 12V vehicle battery.



only three controls: an on/off switch, focus control and eyepiece adjustment. Power is derived from a single 2.7V battery, which affords up to 66 hours continual use.

**Employment:** Nova is in service with the British Army and several other armies.

**Night Observation Device NOD 'A':** A passive long-range sight for use as a surveillance device and for artillery fire control, NOD 'A' features a catadioptric (reflective) lens configuration and a 40mm cascade image-intensifier tube, which affords an overall luminous gain of up to 80,000 times. Power is derived from a single 6.75V battery. A biocular eyepiece is incorporated, with the user benefiting from an eye relief of 120mm; this large eye relief provides a degree of user comfort by reducing eye fatigue. An illuminated graticule is incorporated to aid artillery fire control, while provision can be made to accept a laser target market or a laser range finder.

**Employment:** NOD is in service with the British Army and several armies worldwide. It is particularly suitable for static OPs or sentry posts in IS situations.

**Snipe Individual Weapon Sight:** Snipe is a compact, lightweight night sight and is designed to meet a demanding military specification for weapon aiming sights. Featuring

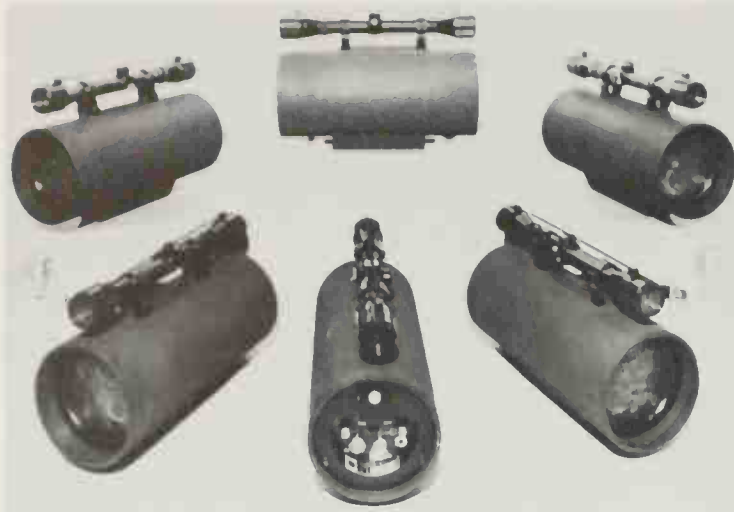
the latest advanced technology in electro-optics, Snipe features a catadioptric lens configuration and an 18mm micro channel plate image-intensifier tube. With power derived from two 1.5V commercially available batteries, Snipe affords a very high gain and a field of view of 15°, with overall magnification of  $\times 2.3$ . A feature of the second generation tube is that bright sources of light such as muzzle flashes or headlights become localized in the image and do not cause a washed out view. The wide field of view permits quick target acquisition, and Snipe is adaptable to a large number of weapons. An adjustable internal aiming graticule is incorporated; this can be illuminated to assist vision when viewing objects of varying contrast.

**Employment:** Snipe is in service with the British Army and several armies worldwide.

### Pathfinder Portable Searchlight

The aviation specification sealed beam of this light can illuminate objects up to half a mile away, and can be seen from a distance of ten miles. The Ni-Cad batteries can be recharged up to 2,000 times, and the unit floats beam up. Dimensions are 410mm  $\times$  95mm diameter; duration is an hour and a half of intense light from the 50-watt model.





### Plessey Surveillance Systems

**Long Range Man Detector:** Developed by Plessey Optoelectronics and Microwave Division, this consists of a ceramic pyro-electric IR detector and is designed to respond to the IR radiation emitted by a man in the 8-14 micron region of the electromagnetic spectrum. It can therefore readily detect a person against a background of buildings, night or day, at a range of 100m. The field of view at this distance is approximately one metre in diameter, and the accurate telescopic sight allows precise alignment of the detection unit. The relay circuit can be used to activate an alarm or trigger a camera and is therefore best fitted on a tripod, although it could be used in a patrol situation.

**Employment:** The British Home Office purchased six units for trials.

**Data:** length 31.4cm; diameter 14cm; weight 5kg; field of view 1°; battery 9V; battery life approx. 3 months; range 100m.

**Perimeter Protection System 3PS:** This is an intruder detection system that relies on special co-axial cable that can be concealed on a perimeter wall or buried in the ground. If an intruder enters the area near the cable an alarm is triggered. Unlike many beam-breaking systems, detection is effected by the whole body of the intruder, thus giving a better discrimination against birds and small animals. When used in open ground, the equipment can be completely concealed by being buried at depths of up to 0.5m. Irregular local topography presents no problems. The system comprises an electronic driver unit connected to a pair of radiating co-axial cables, each up to 200m long, separated by approximately 2m. The cable pair is arranged to follow the perimeter or boundary of the site to be protected. Movement of an intruder in the vicinity of the cable triggers an alarm, which is indicated at a control centre. One of the cables is connected to a low-power r.f. transmitter, the other to a receiver. The movement of human intruders disturbs the r.f. field established between the cables such that an imbalance occurs. This generates the alarm signal.

The 3PS cable pair can follow the lie-of-the-land and does not depend upon line-of-sight conditions. It can ideally be concealed by being buried or hidden behind the walls, and is thus difficult to detect. Cables can be laid under road surfaces or concrete. The cable pair can follow changes in direction, and thus the full 200m length can be used irrespective of the number of corners there may be on the perimeter. This compares favourably with

**Top left:** Multiple view of the Plessey Long Range Man Detector.

**Below left:** A demonstration of how the Plessey 3PS perimeter Protection System should be installed.

**Top right:** Bataco Bayonet Barb barbed tape concertina from Prince Perimeter Security.

**Below right:** The Racal CLASSIC Remote Ground Sensor System in operation. In real operations the device would of course be camouflaged.

systems that depend on a clear line of sight between transmitter and receiver units. For sites where the total perimeter exceeds 200m, two or more equipments and associated cables can be used in tandem to provide full boundary protection. Each sector provides independent alarm indications at the control centre without electrical interaction between equipment.

**Data:** *dimensions of drive unit* 20cm × 15cm × 10cm; *weight of drive unit* 2.5kg; *selector length up to* 200m; *detector dimensions* 1–2m (height), 3m (width).

### Prince Perimeter Security Equipment

This firm specializes in protective fencing, including Bataco Standard Barb, a concertina barbed tape that makes an effectively impassable entanglement; and Bataco Bayonet Barb, a new, sharper concertina fencing material. They also design and supply fencing and gates, including instant barriers. A barbed wire spreading trailer is available, and this enables a two-man team to spread 110 metres of barbed wire 1.5m wide by 1.6m high in two minutes. (Collecting takes the driver and 6 people 4–5 minutes.)

### Racal CLASSIC Remote Ground Sensor System RGS 2740

Racal-SES Limited and the Royal Signals and Radar Establishment have successfully concluded Project LASS (Local Area Sensor System), which detects, classifies and remotely displays 'target' information on personnel, wheeled and tracked vehicles. Extensive trials in association with RSRE have proved this ground sensor system to be highly effective and discriminating in its target classification, and with a low false-alarm rate unequalled by similar equipments. CLASSIC (Covert Local Area Sensor System for Intrusion Classification), is an extension of LASS, offering deployment flexibility and additional sensor (e.g., infra-red) capability. The basic system consists of two main units, the sensor and the monitor. Sensor units, up to eight of which may be used with each monitor, are designed to be hand emplaced at strategic points where there is the likelihood of personnel and/or vehicle intrusion. Each sensor is coupled to a transducer, either a geophone or an infra-red detector. The unit contains signal processing circuitry, which classifies the input and broadcasts a tone-coded message by means of a built-in VHF FM transmitter. The monitor unit receives the VHF FM signal, decodes the data and presents the information on an LED display to show sensor identifica-







tion, type and frequency of intrusion. To extend the range of the sensor transmission, a relay unit is available to receive and retransmit signals from the sensor unit; this is of particular value in areas of poor direct radio propagation. CLASSIC is a modular system incorporating a range of optional accessories, including alternative antennas and battery units, transducers/pressure pad switches and a hard copy printer to meet the requirements of a wide range of ground sensor applications.

### **Rank Pullin Controls Night Vision Devices**

Rank Pullin Controls of Loughton, Essex, have manufactured night vision equipment for the British Army and many other armies worldwide for many years. The 'Twiggy' surveillance sight has done valuable service with the British Army in Northern Ireland, and the Individual Weapon Sight (IWS Type SS20) had been in service for many years.

#### **Individual Weapon Sight IWS Type SS20:**

With a magnification of  $\times 3.75$ , this device offers the user detection capability at 700m, recognition at 500m and identification at 300m. Data: field of view 10°; length 478mm; width 100mm; height 139mm; weight 2.78kg.

**Employment:** In service with British Army and other armies worldwide.



**Top left:** A Racal CLASSIC ground sensor being deployed.

**Below left:** The Racal CLASSIC control unit, which can receive signals from up to 8 sensors.

**Right:** The Rank Pullin Individual Weapon Sight SS20 mounted on an SLR rifle. This device has been in service with the British Army for some time.







**Lightweight Night Sight SS80:** With magnification of  $\times 3.8$ , this sight affords recognition of a standing individual at 400m in clear starlight ( $10^{-5}$  lux). The SS80 is a second generation equipment. It has the same performance as the older SS20 but for half the weight. This is a most important improvement.

**Data:** field of view  $9.9^\circ$ ; length 285mm; width 75mm; height 90mm; weight 0.94kg.

**Night Pocketscope SS82:** The field of view ( $20.4^\circ$ ) and magnification ( $\times 2$ ) of the Pocketscope make it ideal for map reading, navigation and surveillance by night.

**Data:** range 210m (recognition of standing individual in clear starlight,  $10^{-5}$  lux); length 230mm; width 75mm; height 70mm; weight 0.7kg.

**Integrated Thermal Imagers Series SS600:** The SS600 is a high performance system for long range thermal surveillance. It combines telescope scanner and processing electronics unit (PEU) within one compact, environmentally sealed body. Operating in the 8–13 micron band, it uses advanced 'SPRITE' detector technology to produce a TV/video-type display with high thermal and spatial resolution.

**Data:** magnification  $\times 3/\times 10$  dual field of view; fields of view  $13^\circ$  ( $\times 8.5^\circ$ ) and  $4^\circ$  ( $\times 2.6^\circ$ ); length 425mm; width 29.2mm; height 280mm; weight 15kg.

### Rank Telecommunications Mitre Two-Way Surveillance Equipment

Mitre VHF surveillance equipment is designed to be worn discreetly under a shirt or jacket using the special surveillance harness. If IS personnel need to work covertly, Mitre is used in conjunction with a miniature microphone, small press-to-talk switch, a radiating inductor coil and a miniature earpiece. The microphone, inductor coil and press-to-talk switch are connected to the Mitre radio by a simple wiring harness, worn underneath the coat or shirt. The earpiece receiver has a self-contained battery and does not require any external wiring, as it receives its signal from the radiating inductor coil. This equipment when correctly worn is virtually undetectable and has proved its worth in many situations where the open use of radio communications might have caused alarm.

**Data:** weight TX/RX unit 0.275kg; battery weight 0.21kg; frequency coverage 68–100MHz, 145–174MHz; mode FM, simplex single- or two-frequency; channel separation 12.5KHz or 25KHz; number of channels 1–3; endurance 10–13 hours.





**Top left:** The Rank Pullin Type SS80 Hand-Held Night Surveillance Device.

**Below left:** The Rank Pullin Type SS82 Lightweight Night Pocketscope/Weapons Sight mounted on a Sterling submachine-gun, here seen in a military situation.

**Above:** The Shorrock 033 Microwave Fence deployed to provide security for an RAF Lightning interceptor.

### Security Equipment Supplies Night Vision and Optical Equipment

Models include WN 2/91, a lightweight night vision sight that offers a  $10^\circ$  field of view and a  $\times 4$  magnification; range is 300 metres for a man-sized target in overcast starlight  $10^{-2}$ . Model WN 3/155 is a long range sight with a  $6^\circ$  field of view and a  $\times 6$  magnification.

**Tyre Trap:** This portable unit is designed to puncture tyres and effectively stop a vehicle without causing injury. It can be deployed by two men covering a gap up to 21 feet in 15 seconds. The complete unit weighs 15kg including metal storage box.

### Security Systems International Surveillance Equipment

**Viper Remote Terrain Surveillance Transmitter:** SSI of London market a packaged miniature television camera, transmitter and remote radio command control receiver system for exterior field picture surveillance. It can be used with any domestic TV receiver.

### Security Systems International Telephone Monitoring Equipment

**Telephone Monitoring Equipment:** ATR 293-11 Telephone line monitoring and Voice Logging Control Unit handles 11 lines at the same time. ATR 293-11 Monitor Interface Unit connected to an ATR 293-PPR Driver Unit for controlling a printer prints 27 lines at the same time and will also put a visual display on a television monitor screen. It can be used with any TV monitor or any printer with a centronics or RS232 Interface. ATR 293-27 Telephone line monitoring and Voice Logging

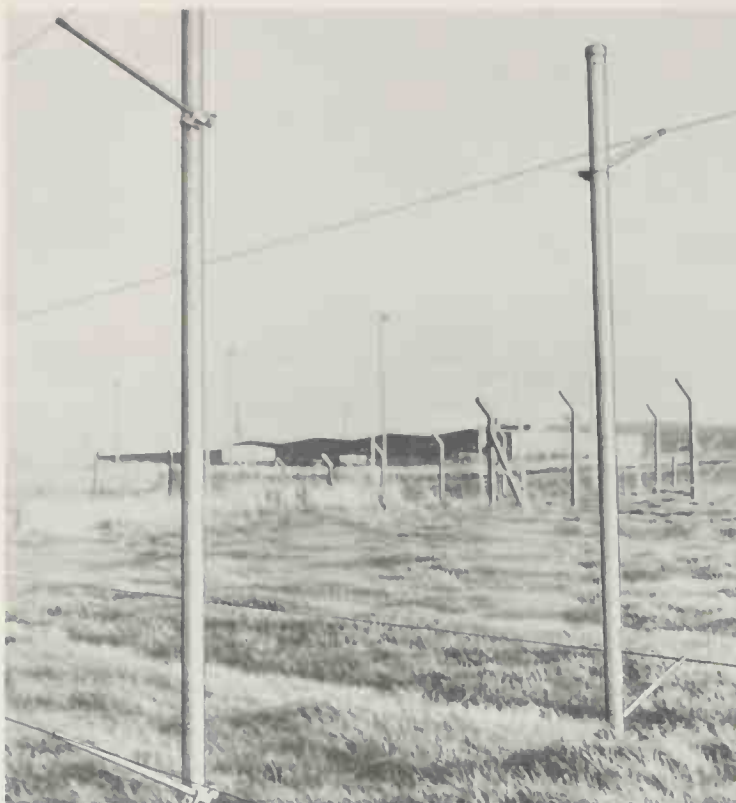
Control Unit handles 27 lines at the same time. ATR 293-DD gives direct display of a dialled number unit. It provides a visual readout of any numbers dialled on a target telephone and holds 200 sets of numbers in memory, even when power is removed. TDL-21 Audio/Dialled Number and Date Time Recover/Reader Unit for decoding information contained on audio tapes made via any ATR system also holds 100 sets in memory.

### Shorrock Security Systems

Shorrock Security Systems of Blackburn, Lancashire, specialize in providing totally integrated security systems. At the heart of the integrated system is the control centre, the function of which is to receive information from a multitude of sources, collate and analyze the data, then present it in a very short space of time.

**Microwave Fences Model 033:** A bi-static system using a microwave transmitter and receiver. Processing circuitry within the equipment measures the received signal and generates an alarm condition when the change in the received signal level varies from pre-defined limits. The unique antennae configuration produces a narrow azimuth beam angle and consequently a far more controllable field detection pattern, which greatly reduces nuisance alarms. This allows installation close to building structures and fences. The antennae design and electronic processing circuitry give Model 033 the ability to detect movement at speeds below 1.5cm/second. Security features are built into the equipment to prevent countermeasures. In addition to tamper-proof operation, the most significant is the anti-capture capability. Unlike many conventional microwave systems, the 033 receiver responds to both increases and decreases in the received signal level: this effectively minimizes equipment capture by a secondary transmitter.

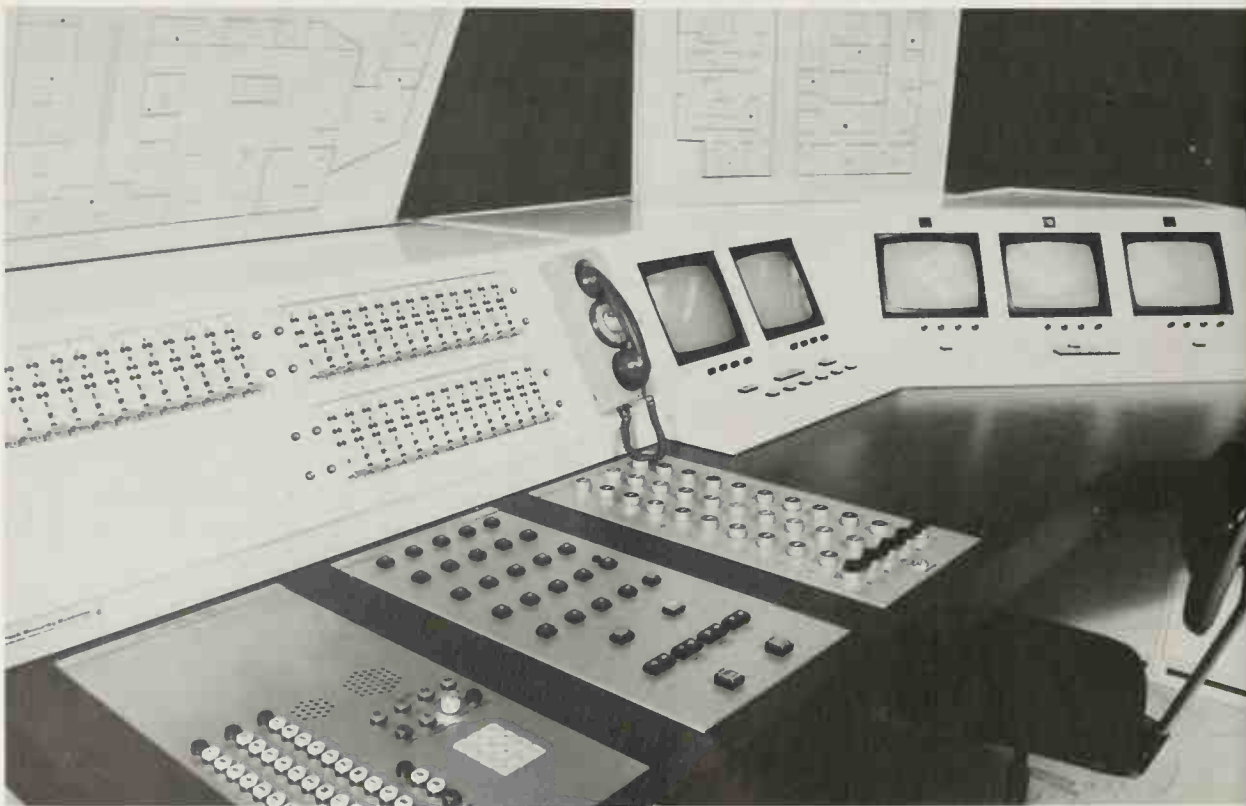
**T Line System:** This consists of a pair, or pairs, of sensor wires excited at a low radio frequency; a balanced system is created where the voltage, current and frequency in each T line wire pair are in amplitude and phase balance. When an intruder disturbs the effective field of one of the lines, a system imbalance occurs, and this is measured by the T line processing electronics for magnitude and rate of change. If these are characteristic of human intrusion, an alarm is generated. Additionally the sense wires are continually monitored, and if any are tampered with, such as by cutting one of the lines or shorting to the



ground, a separate maintenance alarm is generated. The system can be configured, physically and electronically, to give 'proximity' and touch-sensitive operation to meet specific security applications. It is extremely flexible and can be used effectively to provide free standing, fence mounted, roof, wall and roof space protection.

**Digital Access Systems:** Shorrock provide a two-to-six digit, easily changed, programmable code, digital access system. If something more sophisticated is required, they can provide centrally controlled multi-point entry systems. This latter system can cope with up to 800 cardholders.

**Employment:** Shorrock experience in security systems extends to over 30,000 installations worldwide. Full maintenance and logistic support is available to all clients; approximately 15,000 installations are currently under active maintenance. Strategic site protection categories where Shorrock are involved include nuclear power stations, ordnance factories, ammunition and explosives storage compounds, research airfields, operational military airfields, civil airports, national police HQs, prisons and penal institutions, naval bases, government buildings, research laboratories, army and police compounds, military





**Top left:** The Shorrock T Line System.

**Below left:** One of the versions of the Shorrock Perimeter Security System Control Centre. This centre controls the interior of a large building, unlike the system depicted on page 189.

**Below right:** Thorn EMI's Watermark Magnetics identification control system in operation.

communications sites, radar sites, oil terminals, oil refineries and pipelines, natural gas and development sites, missile sites, police and military communication sites, dams and aqueducts and electricity generating sites. The location of these installations and other Shorrock customers extends to the following countries: Australia, Austria, Bahrain, Belgium, Brunei, Canada, Colombia, Dubai, Eire, France, Hong Kong, Indonesia, Italy, Japan, Malawi, Malta, Netherlands, New Zealand, Norway, Oman, Peru, Qatar, Saudi Arabia, Sharjah, Singapore, Spain, Switzerland, USA, West Germany, Zaïre.

### Thorn EMI Security Devices

**Watermark Magnetics:** Plastic cards with conventionally encoded magnetic strips have become universally accepted over the past twenty years, and during this time the encoding technique for storing information has changed very little. Using readily available modern technology, it is now relatively easy and cheap to alter criminally or copy the encoded data on the ubiquitous plastic card. As valuable encoded data becomes more vulnerable, so the number of fraud attacks increases, and it is now generally agreed that the current level of fraud has reached an un-

acceptable level. Watermark Magnetics tape contains encoded information that is permanently bonded into the magnetic oxide coating. It cannot be copied or altered without destroying its structure. By developing a system to read the Watermark Magnetics encoding, Thorn EMI has enhanced the security features of Watermark Magnetics. This reading system will destroy most fraudulent attempts to simulate Watermark Magnetics and it also checks for two undisclosed parameters found only in genuine Watermark Magnetics tape.

**Employment:** Several UK police forces, British Telecom, UK government establishments and the British Central Electricity Generating Board.

**Observer's Thermal Imaging System (OTIS):** The Thorn EMI Thermal Imager is a passive system, operating independently of ambient light, and has the ability to see through smoke, haze, mist and some forms of camouflage, such as forest and woodlands. Unlike image intensifiers, it is not affected by phosphorous flares or bright light.

**Variants:** OTIS is based on the Multi Role Thermal Imager. Both can be fitted with laser range finders and laser target markers. The Surveillance Thermal Imager (STI) is an







indirect-view configuration of the company's multi-role thermal imager. This system also includes, as an option, a TV camera with 200mm lens. Remote monitors display either a composite TI/TV picture or separate TI and TV via a video mixer. The result is a high performance thermal imager for perimeter surveillance of high-security areas, depots, airfields and harbours. The surveillance thermal imager can be mounted on a mast or building in a static location, or used at any desired location with a tripod. This capability gives the STI increased flexibility of operation and allows it to be used for all general surveillance tasks.

**Employment:** United Kingdom armed forces.  
**Data:** *fields of view*  $12.9^{\circ} \times 7.9^{\circ}$  and  $4.9^{\circ} \times 3.2^{\circ}$ ; *display* red LED raster with illuminated graticule; *weight* 10.7kg (including battery and air bottle); *battery life* 4-5 hours; *air bottle life* 45 hours at  $10^{\circ}\text{C}$  (300 atmospheres charge); *into-action time* 15 seconds.

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## UNITED STATES OF AMERICA

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### Calspan Fingerspan

Calspan Technology Products of Buffalo have developed the Fingerscan system for access control and personal identification. Fingerscan controls the access of individuals by identifying them through their fingerprints, not by a card or a number. To request access, an individual approaches the identification terminal, keys in a number indicating who he claims to be, and then places his finger on a fingerprint reader. The reader scans the fingerprint and transmits the image to the Fingerscan central station. The individual's fingerprints are matched with the descriptive characteristics on file in the system. If he is authorized access, then a positive action (such as opening a door or unlocking a computer terminal) is taken. If no match is made, programable options include additional reading of primary finger and/or an alternate finger as directed. Subsequent unsuccessful attempts will result in an alarm or instructions to call for assistance. A system is made up of a terminal located at each access site and a central station. The system has a military application in a situation where large sections of the population have been fingerprinted. The system would allow random checking of identities at road blocks and other checks.

**Employment:** This system is operated by various government establishments and commercial organizations in the US.

**Top left:** The Thorn EMI Multi-Role Thermal Imager, which is now in service with the British Army and the Royal Navy. It is designed for use in a wide range of thermal imaging applications and can be configured as a direct-view system or the image can be displayed on a VDU.

**Below left:** Thorn EMI's OTIS unit with Laser Target Marker.

**Right:** Calspan Fingerspan, showing a terminal and the central station.



## Communications Control Systems Security Devices

**Eavesdropping Device Detectors:** Model CCTA 1000 scans a telephone line to detect any listening device and pinpoint it with computerized accuracy. It can also sweep premises for bugs, hidden tape recorders and transmitters. The equipment comes in a compact carrying case. Privacy Protector VL 33 is a tiny (cigarette-pack sized) bug/transmitter scanner that verifies a listening device after locating it by letting the user listen to the actual conversation. Privacy Protector VL 34 is equally small and has phase lock loop circuitry. With both these locators, retractable antennae steer the user directly to the bug.

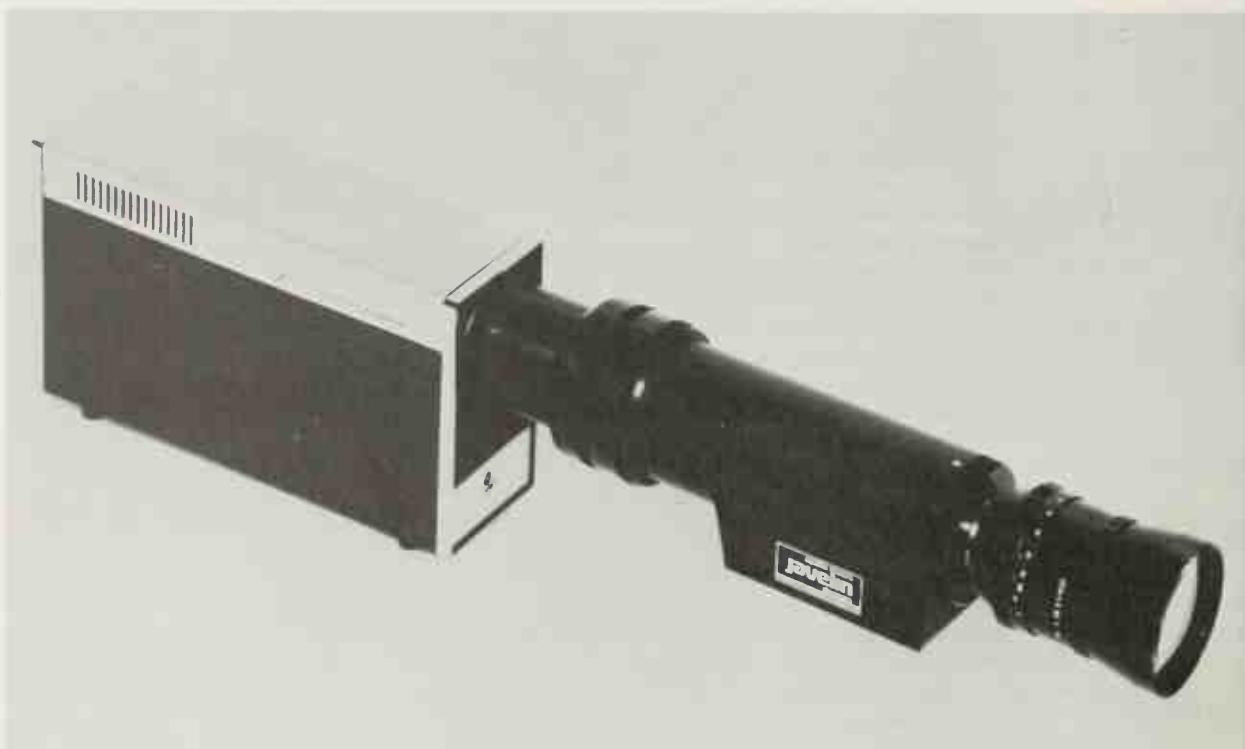
**Surveillance Receiver A-7:** The A-7 Panoramic Surveillance Receiver has been developed to meet the need for a highly sensitive

receiver capable of detecting clandestine transmissions of any kind of modulation. It is a portable unit equipped with a broad band omnidirectional antenna set, which covers the range 5MHz to 1.5GHz. The equipment has a sweep rate that is continuously variable from one sweep per second or less to at least 100 sweeps per second.

**Employment:** In use in the US, Africa, Asia and the Middle East.

## Eye Identification System

With the Eye Identification System 7.5, each individual is identified by a biological trait that goes beyond even the fingerprint in its uniqueness and stability – the retinal blood vessel pattern of the eye. Every person (even an identical twin) has a unique and unalterable retinal eye pattern. Through precision optics and sophisticated computer technology, the



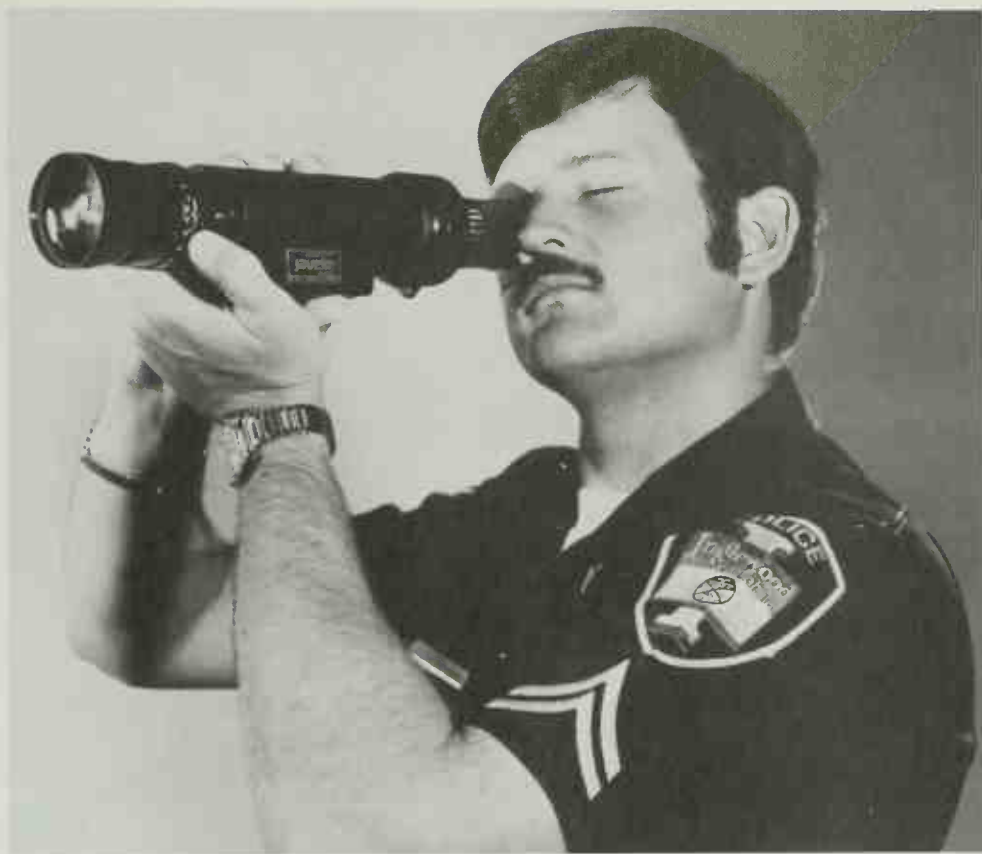




**Top left and above:** The interestingly innovative Eye Identification System.

**Above right:** The Javelin Model 221 Night Vision Device.

**Below left:** The Javelin 221 fitted to a television camera.



7.5 is able to 'read' an individual's retinal eye pattern and distinguish it from all others. Total throughput time, from the moment an enrollee addresses the 7.5 to the point at which release of the security mechanism is activated, averages less than seven seconds. As many as 1,200 eye signatures can be stored in the standard, non-volatile bubble memory of the system. By interfacing with a host computer on a stand-alone or network basis, the memory storage capacity of the system can be expanded to meet the needs of any organization.

### **Javelin Electronics Night Vision Equipment**

**Model 220:** Javelin Electronics of Los Angeles, California, have developed Model 220 for use with TV and photographic cameras, and for mounting on rifles. The equipment can be mounted on a tripod and used with a binocular viewer. This enables the operator to use both eyes during long surveillance duties.

**Variants:** Model 221 is essentially the same as 220, but incorporates a focal plane iris to reduce the field of view and eliminate bright

lights from the edge of a scene, which makes it more suitable for use in an urban area.

**Employment:** Numerous US police departments, Army, Navy, Air Force, FBI, Secret Service, CIA, Australia, Brazil, Canada, Chile, Colombia, Ecuador, France, Iraq, Italy, Japan, Kuwait, Malaysia, Mexico, Panama, Philippines, Puerto Rico, Taiwan, Switzerland, Venezuela, West Germany, Zambia.

**Data:** length 21.5cm; diameter 6.7cm; weight 1.3kg; intensifier gain  $\times 50,000$ .

**Model 222:** A second generation night viewing device that, because of its light weight, is particularly suitable for attachment to cameras.

**Employment:** As Model 220.

**Data:** length 10.8cm; weight 0.95kg; intensifier gain  $\times 45,000$ .

**Model 223:** Designed specifically for military and police applications, this model is currently in use in many countries. It can be adapted to fit almost any rifle and can be used for observation in the field and for aiming a weapon at night.

**Employment:** As for Javelin Model 220.

**Data:** length 33cm; diameter 9.9cm; weight 1.87kg; intensifier gain  $\times 50,000$ .





**Model 226:** This is provided with a binocular viewer on a swinging door type mount with an optional adjacent swinging door for attachment of a TV or photographic camera. The advantage of this arrangement is that a target can be watched by means of a binocular viewer, and then within seconds the doors can be changed to position a camera to photograph the scene.

**Employment:** As for Javelin Model 220.

**Data:** length 45.7cm; diameter 10.2cm; weight 6.1kg; intensifier gain  $\times 100,000$ .

**Model 229:** This is capable of locating and identifying targets at ranges in excess of 1,000m. The target can be pinpointed by reading the co-ordinates on the azimuth and elevation scales on the base of the device. Model 229 is particularly suitable for use in observation posts in urban or rural areas.

**Employment:** US Army, US Coastguard, and other armies throughout the world.

**Data:** length 83.8cm; diameter 26cm; weight 17kg; magnification  $\times 7$ ; field of view  $9^\circ$ ; intensifier gain  $\times 65,000$ ; range 1,000m.

### **Omni Spectra Microwave Intrusion Link Model 300**

Each Model 300 Link provides a detection pattern up to 150m long and 1.5m–5m wide. Properly installed inside a perimeter fence, Model 300 will detect someone approaching the fence from the inside (possibly to throw material over the fence) as well as an intruder who has scaled the fence.

**Variants:** Model 300A has a wider detection pattern of 0.75m to 6.25m. Model 305 may be

used in conjunction with Model 300, but is suitable for shorter sections of perimeter up to 45m in length.

**Employment:** Omni Spectra Intrusion Links are in use in 26 countries, including the United States (Army, Air Force, Department of State, US Postal Inspection, Iowa and Arizona Police Departments, US Secret Service) and Canada (RCMP).

**Data:** sensor length 22cm; sensor diameter 27cm; sensor weight 2.3kg; system weight 9kg; range 15–150m; operating temperature range  $-35^\circ\text{C}$  to  $66^\circ\text{C}$ .

### **Smith & Wesson Night Vision Devices**

**Night Vision Riflelescope Mk 700 Series 1:** An unusually light and compact equipment that mounts directly on most modern military rifles.

**Employment:** Various US police departments, West German police.

**Data:** length 31.8cm; weight 1.6kg; magnification  $\times 3.7$ ; field of view  $10.58^\circ$ ; intensifier gain  $\times 60,000$ ; range 1,000m.

**Night Vision Device Startron Mk 606A:** Designed for long range surveillance, this equipment is best suited for work in a rural environment.

**Variants:** Mk 303A is a smaller, lighter version of Mk 606A and is a hand held rather than tripod mounted equipment.

**Employment:** Various US police departments.

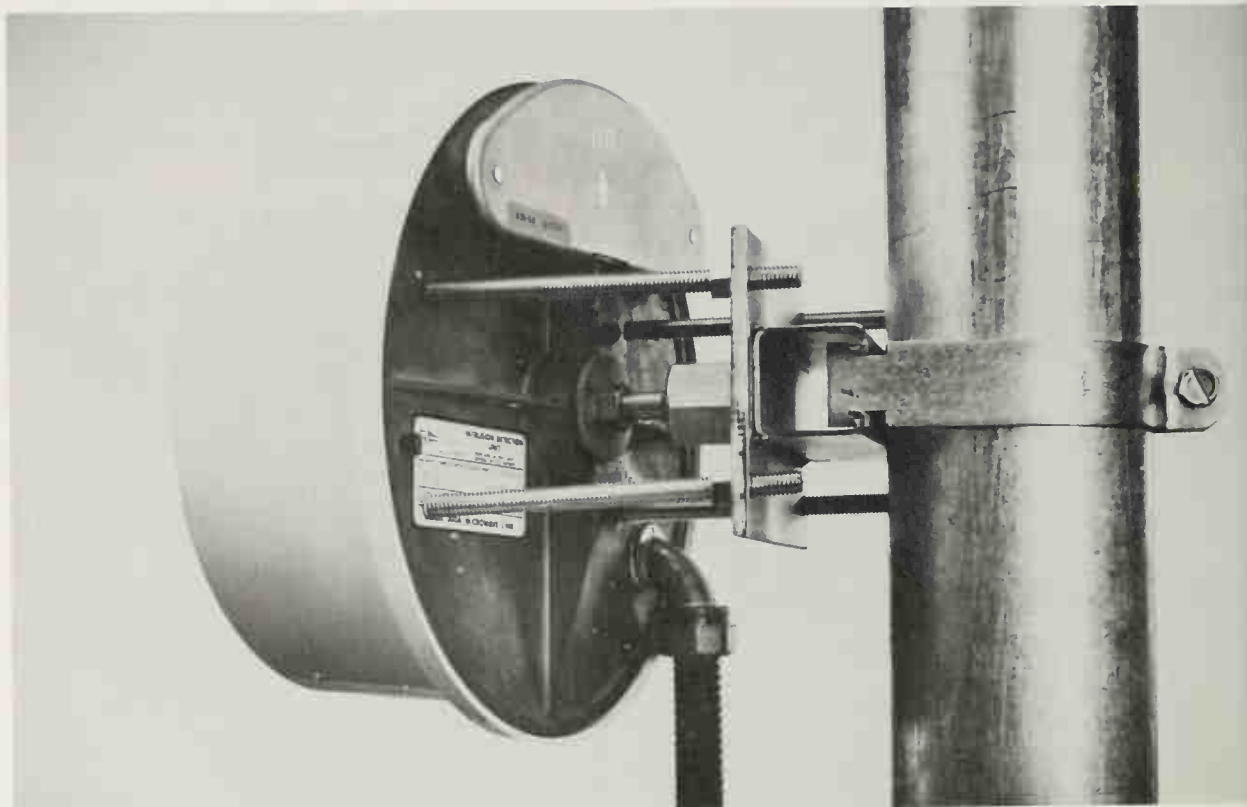
**Data:** length 72.2cm; width 39.4cm; height 51.6cm (with tripod); weight 27.2kg (with tripod); magnification  $\times 7$ ; field of view  $5.3^\circ$ ; intensifier gain  $\times 60,000$ .

**Above:** The Javelin Model 233 Night Vision Device fitted to an M16 ArmaLite rifle.

**Left:** Javelin Model 226 Night Vision Device.

**Right:** Javelin Model 229.







**Top left:** The Omni Spectra Model 300 Microwave Intrusion Link. In common with all microwave systems, this operates on a line-of-sight principle.

**Below left:** A close-up of one of the Omni Spectra Model 300A transmitter/receiver stations.

**Above right:** Smith & Wesson's Passive Night Vision Riflescope Mk 700.

**Below right:** The Smith & Wesson 303A Startron Night Vision System. This can also be mounted on a tripod.





# Special Communications and ADP Equipment

Certain categories of IS equipment are an indispensable part of an anti-terrorist war. In particular, security forces are rarely in a position, particularly in an urban environment, to use conventional radio equipment: it is, by and large, too heavy, bulky and complex. Conventional military radio sets are not efficient in built-up areas, for they require line-of-sight or near line-of-sight transmission paths for best results. Special radio equipment has therefore been developed for IS and police work. In situations where security forces are operating from permanent bases, it is important that transmissions are scrambled or in cipher. This section of the book therefore includes some examples of portable scrambling and cipher equipment, in addition to examples of radio equipment suitable for use in IS situations. Anti-terrorist operations involve the detection of illicit transmitters, and some examples of transmitter detectors and direction finding equipment, as well as encryption units and jammers, are also included. Radiomicrophone detection, surveillance tape recorders, and other bugging equipment are also covered in this section, although they are more accurately categorized as espionage or anti-espionage equipment.

Brief mention must be made of Automatic Data Processing (ADP) equipment in the context of IS operations. Increasing use is being made of ADP systems to speed the passage of information and for data logging. In particular it is possible to computerize vehicle data records, so that security forces can be alerted concerning lost, stolen or hijacked vehicles. Similarly, information and intelligence records previously handled by security forces on a card index system lend themselves to computerization. But learning to live with ADP systems in the context of security does have its problems. Many sections of the public, even in a terrorist situation, find it difficult to accept that private citizens' details are stored in an ADP system – this being in their view an erosion of individual liberty. ADP systems also have problems for their users. The speed and spread of data dissemination means that the onus is

on the *originator* of information to update his data constantly and not keep it in his head as 'background' if the system is to be valid for all the other users who have access to it. This could lead to a state of mind in which an incident or person that elicited no active response from an ADP record system is of no interest or significance. This chapter will not include photographs of ADP systems: pictures of 'black boxes' are not interesting or significant. However, it is important that the place of ADP systems in the fight against terrorism be appreciated.

Communications in an IS context can be considered in two main categories, as follows.

- Strategic Communications. Secure, reliable communications between the political leader responsible for committing the force and the commanders of the government agencies on the ground are extremely important. The political leadership requires up-to-date information on which to base decisions and needs to be able to promulgate orders quickly. In practice this procedure usually involves a government crisis office manned by the responsible minister and his advisors (in secure communication with the head of state) and a tactical incident control centre: these communicate with one another by secure encrypted telephone.

- Force Tactical Communications. The force should be on one 'all-inform' radio net. This is essential if the all-important co-ordination between the different groups is to work. This net will ideally be encrypted, as terrorists are likely to be monitoring VHF and UHF frequencies. The net could be made up of the following elements:

1. *Base station system in the force commander's HQ.* This must provide the force commander with communications to his men throughout the likely area of operations and, at the same time, provide a link with the police and the government official to whom he is responsible. He will therefore require at least two separate channels of communication, one to higher authority and one to his subordinate commander. That to higher authority will probably be a secure telephone link in most circumstances; that to his

commanders will be a secure all-informed radio network. Both the force commander and his subordinate commanders may operate from vehicles or helicopters, so the force radio network must include sets suitable for use with foot patrols, vehicles and helicopters.

2. *Company/team system.* Similarly, the company or team commander will require communications upwards to the force commander and downwards to his sub-units or assault groups. His HQ will therefore be an outstation on the force commander's radio set but will be the base station, or control, for communications with his sub-units or assault groups. In IS urban operations, the platoon as a level of operational command will often be omitted; this may not be the case in rural operations. Thus the company commander is likely to have a large number (perhaps twelve or fifteen) of small sub-units under his command. These could be four to eight men strong and will need to be in touch with company HQ at all times.

3. *Individual hand-held transceivers.* Many of the small sub-units in a company (known in British Army parlance as 'bricks') will be operating in a sufficiently cohesive manner for radio contact between them to be unnecessary. However, in some circumstances it may be appropriate for each member of a 'brick' to be in direct contact with the 'brick' commander by means of individual hand-held transceivers. These should fill the following requirements. They should be small, compact and lightweight and be capable of withstanding exceptionally rough handling. They must be easily operated, body-worn with a 'hands off' operational capability to allow the user maximum freedom to use his weapons or other equipment. The system should be a voice equipment in the VHF/UHF frequency range, with a minimum of three switched channels, and it should contain built-in encryption. It should be able to be used with a covert earpiece: i.e., a condition that cuts off the loudspeaker (essential for sniper, body-guard or covert role). Similarly, it should be able to be used with discreet or covert microphones. Fin-

ally, it should be able to be used with throat microphones. This may, in certain circumstances, be useful for some members of a 'brick'; sometimes it may be necessary to limit this facility to selected members in order to prevent congestion on the net during an operation.

An example of an unusually flexible and adaptable IS communications system is Cougarnet, which is manufactured by Racal, a British company that specializes in military communications systems. (A detailed specification follows later in this section.) A brief description of the Cougarnet concept will serve here as an example of the necessary parameters for an effective IS communications system. Cougarnet is not the only system of its kind, but it is one of the most effective and one of those incorporating the latest technology. The British Army currently uses this equipment in Northern Ireland.

Cougarnet is a totally secure lightweight FM radio communications system, using a synthesizer-controlled hand held radio – the very compact 'basic building block' of the modular system. It is this modular approach that ensures the system is easy to operate and makes Cougarnet attractive to a wide range of military, paramilitary, security and emergency service units. The 2-watt personal radio can be converted easily into a high powered radio by simple connection to an amplifier, and the unit can then be used as a static base station, or a mobile or transportable manpack (depending on power supply). The radio can be changed from one role to another by simply altering the power supply. In the static role, power can be provided from an AC power supply; in the mobile role, the vehicle supply will provide the power. A heavy-duty Ni-Cad battery is used for the transportable role.

The radio can be controlled remotely via an extended control unit, which allows the radio to be stored in a convenient place close to the antenna when being used in the mobile or static roles. At the same time, the radio is always, and easily, available for use as a personal radio by removal from the amplifier and the connection of the battery, antenna

and speaker/microphone. To ensure optimum flexibility in operation, the set has ten programmable channels to gain access to any of several networks. These may be single- or two-frequency simplex.

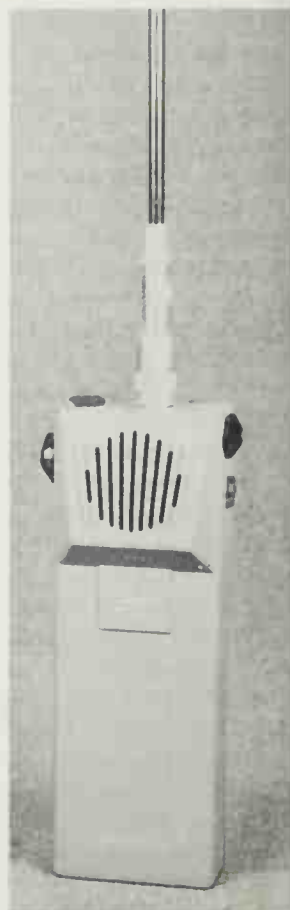
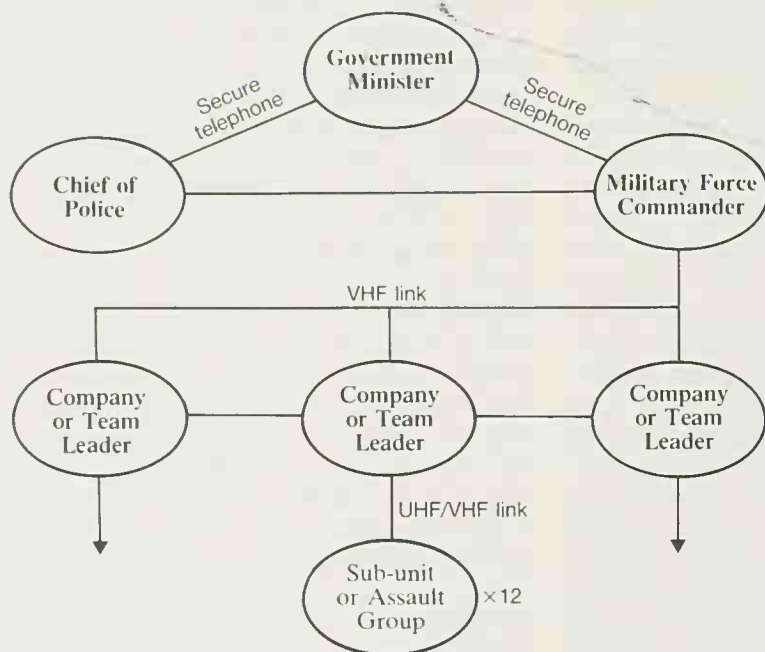
In operation the CougarNet system consists of a number of unattended talk-through stations linked together to allow users operating over different frequencies in different areas to communicate with each other. These links can be switched on or off from a central controller, allowing either independent operation or integration into a command net for combined operations. A station is equipped with two radios, and, in the event of the failure of one, the other is automatically activated. A method of continuous checking is built into the system during normal operation.

Although there has been a move towards push-button control in standard land mobile radio, it was felt that such controls, although perfect for normal environments, would not meet the demands likely to be placed upon them. For example, if an operator finds himself in the middle of an unruly crowd or in riot conditions, speed is vital, and rotary switches

can be operated without looking at the radio, so allowing him to concentrate on the real task in hand. The digital encryption modules built into CougarNet allow two code settings to be used. This gives 'in net' privacy and security and is further enhanced by using a programmer or keyfill unit to change frequencies or codes. This technique eliminates errors and restricts the information to a 'need to know' basis.

Flexible and dependable communications are an indispensable part of all IS operations. In conventional war, operations are to some extent carried on by their own momentum – subordinate commanders are trained to continue to operate despite a break in radio communications, which may be the result of jamming, atmospheric conditions, mechanical failure, bad siting, nuclear effects or a number of other causes. IS operations require political direction, fine-tuning by operational commanders, the facility to negotiate with hijackers, for example, and instant reaction by assault forces. All these demand totally reliable communications. This part of the book includes a representative cross-section of the systems available.

**Typical IS Communication System**







**Above:** The Philips 'Pocketfone' Personal Two-Way Radio Type PFX.

**Above right:** The Spanish Intal Radiotelephone FM-007.

**Left:** The MF603/673 Portable transceiver manufactured in France and used by the CRS.

## ISRAEL

### Tadiran Palm-Held Transceiver PRC-601

As a replacement for the veteran AN/PRC-6 combat soldier's hand held transceiver (operating on valves), the Israeli company Tadiran developed a compact, solid-state FM/VHF six-channel palm-held unit, designated PRC-601. One version of this transceiver, the PRC-601S, has been developed specifically for naval commandos and combat drivers. Tests have demonstrated that the unit can withstand a pressure of 4.5 atmospheres without leakage, thus requiring no special precautions for most underwater applications. At depths of over 45m, special plugs are required to protect the microphone and earphone. The set is also protected against sea water and oil damage. The PRC-601S can be operated when the frogman's head and shoulders are above water. Communications range is about 15km to shore or a surface ship.

**Employment:** Israeli Armed Forces.

## THE NETHERLANDS

### Philips Communications Equipment

**Voice Logging Systems:** These were developed specifically to meet the need for continuous

recording of communications – in IS situations the logging of radio conversations during an incident may provide vital evidence in securing convictions. Instructions given in an emergency can also be analyzed after the event. To meet communications recording requirements of varying complexities, Philips offers a range of three distinct voice logging systems. These cover different recording densities, the number of communication channels that may be in use simultaneously. They all share a continuous 24-hour recording capability (or 48 hours on the dual-deck systems), with varying back-up and alarm facilities to ensure that recording continues without interruption should a fault develop.

**Personal Two-Way Radio 'Pocketfone' Type PFX:** This lightweight portable equipment is powered by a rechargeable nickel-cadmium sealed battery pack and offers up to 99-channel operation. It is frequency-synthesized, and there is a choice of power output.

**Data:** *dimensions* 167mm (standard case version), 190–220mm (extended case versions) × 62.5mm × 33mm; *weight* 480g; *frequency range* 68–88MHz and 132–74MHz (VHF), 405–512MHz (UHF); *power supply* 9.6V; *endurance* from 4 hours (4W UHF with high-capacity battery) to 21 hours (1.5W VHF with high capacity battery) based on 2% transmit, 10% receive and 88% receiver standby.

## SPAIN

### Intal Radiotelephones

Intal, of Almeria, produces numerous types of radiotelephone, including the FM-007 walkie-talkie, which is intended for military, police and surveillance operatives. Equipped with a speech compressor and integral microphone, it works in the 146–174MHz and 68–87.5MHz band and can be supplied with a power output of 1 or 2W. It has six channels in 25kHz steps. Powered by Ni-Cad rechargeable batteries, it weighs only 600g.

## SWEDEN

### Transfertex Cipher Equipment SR-22

The SR-22 speech signal is digitalized and enciphered by adding a pseudo-random pulse series, usually known as a superimposition series. The same superimposition series is added for deciphering, after which the signal





**Top left:** The Transfertext SR-22 Cipher Device from Sweden.

**Left:** Audiotel's Scanlock 2000 portable radio transmitter detector.

is converted back into normal speech. The superimposition series is controlled by the actual key setting, which can be altered by the operator and is therefore known only by him. The SR-22 is designed for use in radio and radio link communications in the VHF and higher frequency ranges. It can be used on local telephone lines (up to 15km) by means of the SRL-12 adaptor.

**Variants:** The SRL-12 and SV-22 are alternative equipments for ciphering speech on local and longer range telephone links respectively.

**Data:** *dimensions* 24cm × 19cm × 8cm; *weight* 3.2kg; *different key settings* 10<sup>25</sup>.

## UNITED KINGDOM

### Audiotel International Communications Equipment

Audiotel of London produce a range of communications equipment, much of which has special relevance to IS situations. It includes radio transmitter detectors, encryption equipment, radio surveillance systems, miniature VHF transmitters, receivers and miniature speech scrambler modules.

**Scanlock 2000:** This radio transmitter detector works in the 10MHz to 4GHz bandwidth. The basic unit is portable, weighs only 5kg, and its dimensions are 350mm × 285mm × 160mm in its carrying case. Scanlock is not limited to detecting standard radio microphones: it is capable of detecting the more sophisticated scrambler microphones and other non-audio surveillance devices used, for instance, against computer installations, which would defeat most detection systems. Scanlock 2000 can be left on guard for continuous real-time protection in any sensitive area and will give an immediate alarm if a radio transmitter is activated. It also detects microphones that use standard mains cables for power and transmission.

**Voicelok 100:** Voice transmission over telephone networks is vulnerable to interception unless measures are taken to make the speech secure. Although this need for secure voice communication has been recognized for many years, the cost of the encryption equipment has been a major factor in its use being restricted to military and government departments. Advances in technology have now made it possible to build complex and sophisticated encryption equipment that is attractive to all markets. Voicelok 100 secure telephone has two operating modes, 'clear' and 'secure'. In the 'clear' mode, the user has a standard

duplex telephone link; in the 'secure' mode, the user is provided with a high level, secure transmission link. An illuminated push-button is provided for switching between modes.

**Radio Surveillance Systems:** Audiotel make surveillance systems for law enforcement, defence and security applications, including equipment for undercover interviews and negotiations, one- and two-way covert communications, protection of couriers, surveillance of vehicle occupants, siege and barricade use, single- and multi-channel telephone monitoring, and surveillance of detention, interview and conference rooms. The systems are based on the following Audiotel products. **Special microphones:** Sub-miniature and small-diameter probe type microphones are available.

**Transmitters:** VTX-12 and VTX-22 are VHF/FM voice transmitters with excellent audio quality, automatic microphone gain control, user-selectable voice activation (VOX) and external control through a push-to-talk or other switch. These transmitters are available with the Audiotel miniature speech scrambler fitted.

**Receivers:** VRX-SL and VRX-ML are single- and multi-channel VHF/FM receivers with outputs for headphones and inductive earpieces, tape recorder, and control of external equipment.

**Amplifier:** VA-095 is intended for use with a wide range of microphones, and features high microphone gain and user-selectable voice-activated control of external equipment.

**Auto-cascade recorder:** Cassette-based for easy recording access and operation, this recorder incorporates tape-end approach alarms, which warn the operator to change tapes. Two or more recorders may be linked to extend unattended recording times.

**Accessories:** A wide range of accessories is available to enhance operation of the above systems. These include headphones, inductive earpieces, transmitter telephone adaptors, miniature aircraft and vehicle power supplies.

**Miniature Speech Scrambler Module:** The Audiotel scrambler module has been designed for installation into existing communications equipment and as a building-block in new systems. Using fixed frequency inversion, the module renders speech unintelligible to any listener without a similar unit. The module provides excellent protection against casual interception of voice communications, making it ideal for lower level security applications. The module, which carries out both the scrambling and unscrambling processes, measures only 47mm × 25mm × 5mm. Low



voltage and current requirements, crystal control, together with on-board input and output level controls, simplify installation and use of the module.

#### **EMI Communications Security Devices Bughound Concealed Transmitter Detection**

**Device:** The EMI Bughound radiomicrophone detects and locate most 'bugs' – concealed transmitting electronic eavesdropping devices. It incorporates facilities for detecting devices using electrical mains wiring for carrier-borne signals as well as those using radio transmission techniques. The compact, portable unit provides audio and/or visual indication of the presence of 'bugs'. It is powered by self-contained batteries and has straightforward switch-operated self-test and search-mode controls. Detection of an eavesdropping transmitter device is registered by a red indication on the meter display, and a change in the tone heard in a small earphone monitor. Further verification of the presence of a device is possible in most cases by a second simple test routine, where its transmissions can be heard in clear audio through the earphone.

#### **Telephone Scrambler Type 1313 Privateer:**

Developed by the EMI Sound and Vision Equipment of Hayes, Privateer scrambles telephone conversations by inverting speech frequencies and producing a jumbled sound that can be understood only by a person at the other end of the line with a compatible unit. Privateer has commercial and military applications, and could be used at military or police static installations.

**Variants:** The portable version of Privateer, Type 1314, could have a police application, but is probably best suited to commercial use.

**Employment:** Numerous private companies in UK, Europe and the Middle East.

**Data:** *dimensions* 15.6cm × 9.5cm × 25.7cm; *weight* 4kg.



#### **Microcode Secure Voice Module**

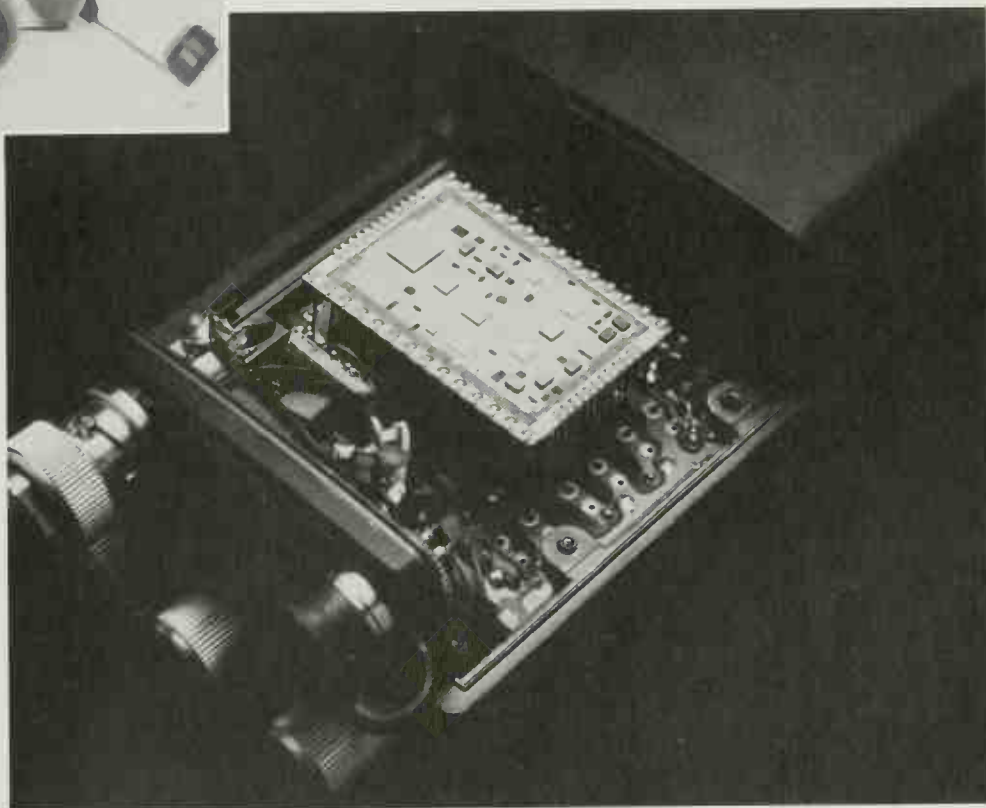
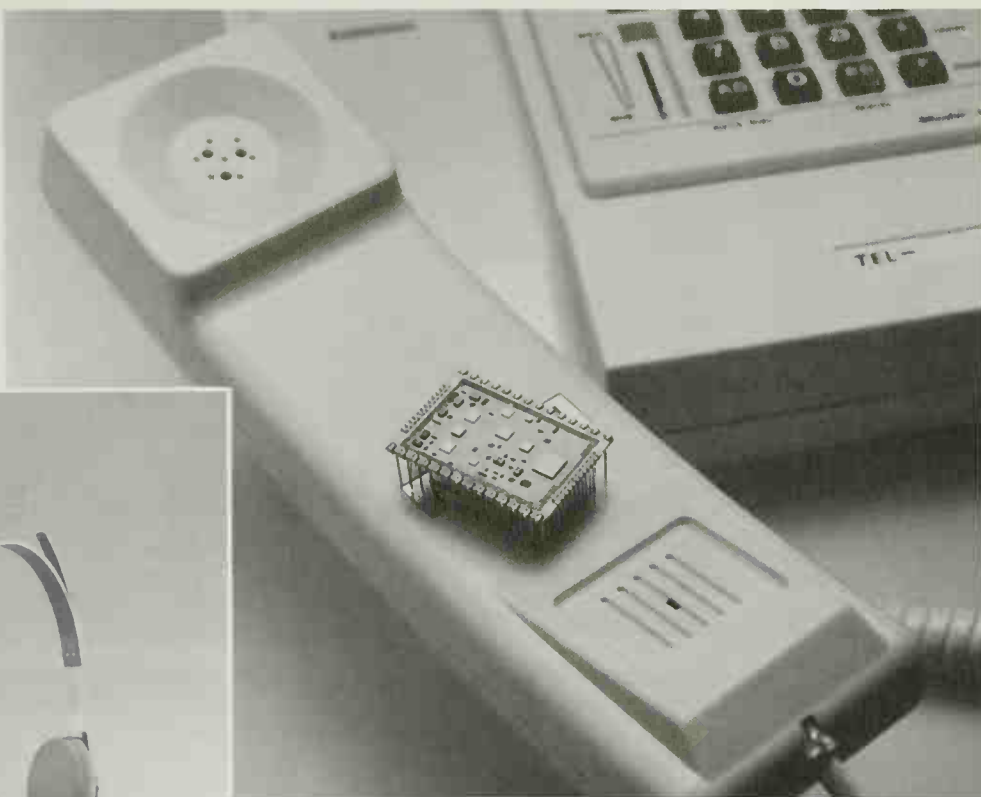
A secure-voice system very carefully mixes the voice patterns in a coded fashion so that they are rendered unintelligible to an eavesdropper. If both parties are in possession of an identical code combination, they should be able to hold a conversation over that secured link without losing good voice intelligibility and user recognition. If the code combination is changed continuously to a pseudo-random pattern, then at any particular moment the eavesdropper must have the ability and knowledge to change in time with the changing code. Microcode Secure Voice Modules use

**Top left:** The EMI Bughound equipment for seeking out hidden listening devices.

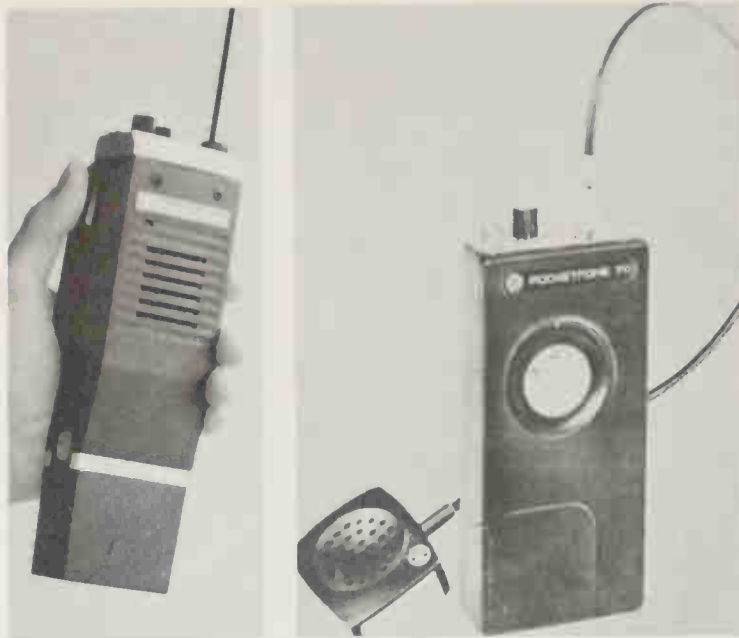
**Below left:** EMI's Privateer Portable scrambler, a typical unit. There are many manufacturers of this sort of equipment in the USA.

**Right:** The Microcode Secure Voice Module.

**Below:** Pace Landmaster III, a duplex portable affording hands-free operation.







analogue techniques under digital control to attain a medium to high level of voice security economically. The modules are tiny micro devices incorporating a complete voice encryption system; by using large-scale-integration (LSI) and thick film techniques, Microcode have reduced the overall dimensions of the chip to about the size of a 35mm photograph transparency. Microcode LSI has replaced over 100 conventional integrated circuits and associated components. As a result, possible failures during production are greatly reduced, and the product's reliability is substantially improved.

### **Pye Pocketfone Series P5000**

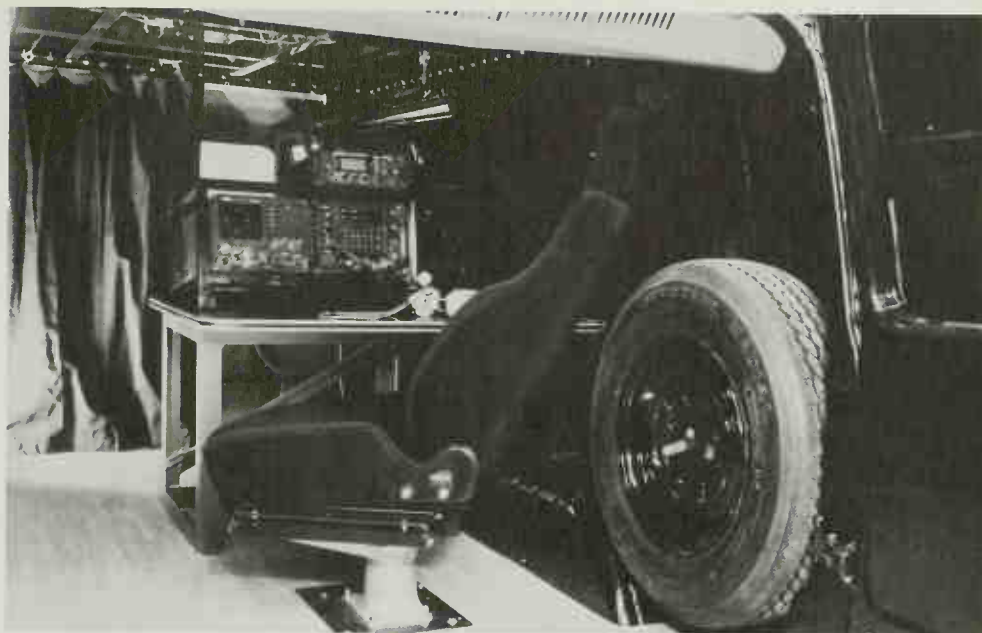
In 1977 Pye's Pocketfone P5000 Series became available as the natural successor to their 70 series; the latter is still in service in many parts of the world. Pocketfone P5002 is a multi-purpose portable. In a single unit, it combines both body-worn and hand held applications, and claims to achieve this with-



**Top far left:** The Pye 'Pocketfone' P5000. It is here shown in the hand-held mode; there are attachments allowing the set to be clipped to the belt under a coat or fitted to a vehicle dashboard. A special mounting affords desk-top use.

**Left:** The Pye 'Pocketfone' 70, an older set that was widely used by the British Army in Northern Ireland.

**Right:** Racal Communications Equipment's Hunting Device 3200. This covert system is suitable for internal security work, where illegal or terrorist transmitters are operating.



**Left:** The Plessey System 5000 range of fixed, mobile and hand-portable radios, with facilities for everything from straightforward single channel links to computer controlled systems providing clear and encrypted speech and data.

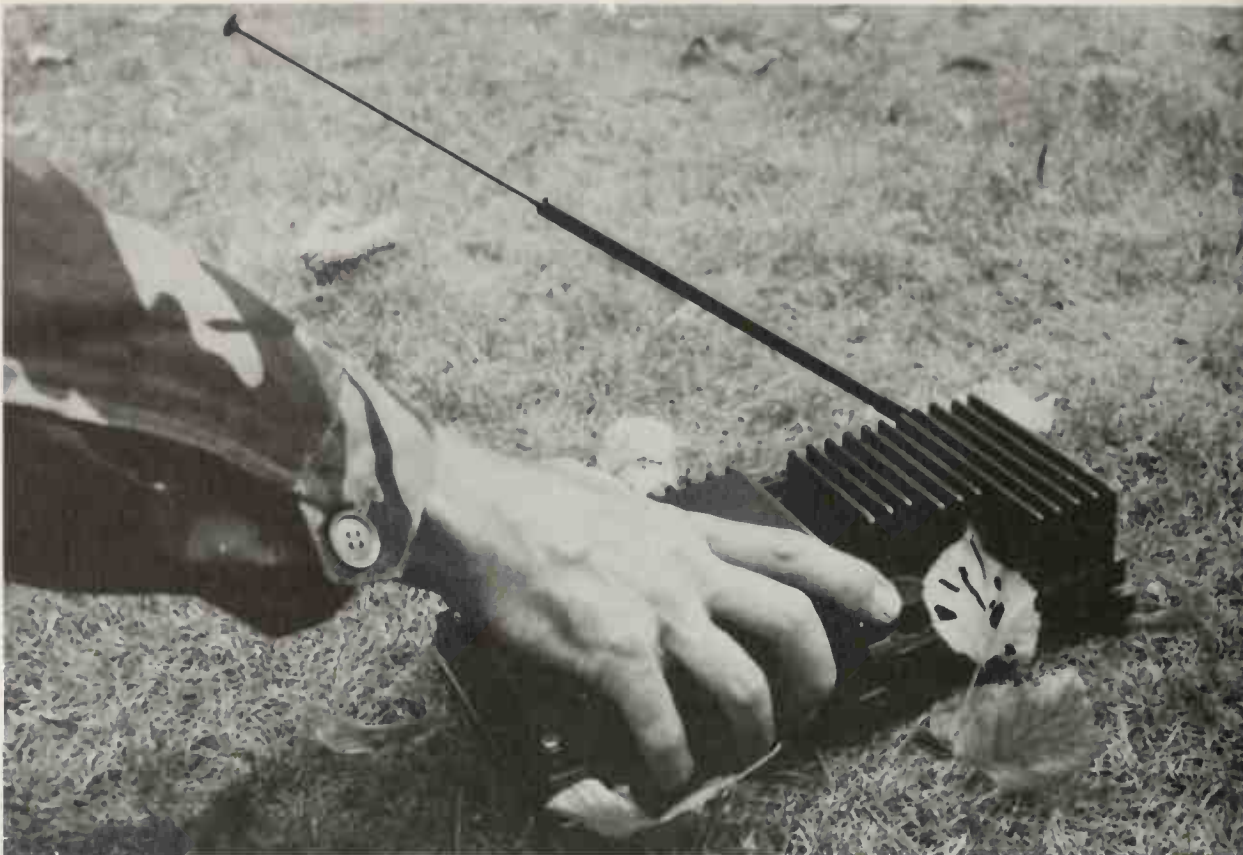
out degrading performance or operating efficiency in either mode. The quick-release holster, which secures the 'Pocketfone' in its body-worn mode, is equipped for rapid automatic switching of the essential send/receive facilities to or from a handy loudspeaker microphone unit suitable for clipping to the lapel of a coat. While all items are robustly constructed, this feature ensures that no loss of communication need result from damage to peripheral items, since the transceiver can be snatched from its holster for instant use as a hand-held unit. Operational flexibility of the Pocketfone is further extended by its ready adaptability for use inside vehicles, where problems of screening arise. A vehicle adaptor has been designed to accept the Pocketfone, making automatic connection to the vehicle antenna, a battery fast-charge facility powered from the vehicle supply, and an audio amplifier. The installation, completed by a standard mobile microphone and loudspeaker, gives the equipment mobile performance with enhanced operating range. Pocketfone can be locked into the adaptor for security, yet is ready for rapid reversion to its portable role at any time.

**Data:** *operation* single- or two-frequency simplex; *modulation* frequency (phase); *channels* single up to four (6-channel versions available and 12-channel versions under development); *dimensions* 214mm × 76mm tapering to 66mm × 44mm; *weight* 830g (hand held mode), 227g (loudspeakers/microphone unit).

### Racal Communications Equipment

Racal Communications of Bracknell, Berkshire, is (like its sister company Racal Comsec) part of the Racal Group of Companies. It produces direction finding equipment, radio interception systems, remote ground sensor systems (sometimes known as unattended ground sensors or UGS), unattended expendable jammers, and portable or mobile jamming systems. Much of this type of equipment has direct relevance to Internal Security operations.

**Hunting Radio Direction Finding (RDF) Series 3200:** The RDF3206 Direction Finding System has been specially designed for mobile operations in the VHF/UHF bands (25–512MHz). It is intended for use by internal security forces in 'hunting' illegal transmitters and is well suited to operations in urban areas. The equipment can be installed in a variety of vehicles to fit the operational role, and there is full provision for concealment in the type of operation where secrecy is a paramount consideration. The system is based on Racal's well established RTA1470 series general purpose DF equipment, but, by adapting the antenna design for mobile operations, a version has been produced that can be used in single station mode to home-in on a target transmission by taking successive bearings on the move. It can also be used as part of a DF net in conjunction with other hunting vehicles or with a fixed DF site. By the addition of mast mounted antennas (AE3020 series) the system can be quickly converted to fixed



**Above:** The Racal RJS3140 Unattended Jammer.

location use with considerably enhanced performance.

**Antenna System AE3022:** The Hunting DF antenna system, which can also be used for monitoring purposes, covers the frequency range 25–512MHz with two Adcock arrays – low band (25–110MHz) and high band (110–512MHz). The two arrays, each consisting of four monopoles, are mounted on an aluminium plate with a common combiner module. Both sets of monopoles can be quickly mounted or dismounted as required, the normal procedure being for the low band array to be removed when the high band is being used. The antennas are aligned with the vehicle heading so that operational bearings indicate the direction to be taken when homing-in on a target. A standard Racal receiver is used – either the RA1795 (20–512MHz) or the RA1794 (2–512MHz). Only one receiver is required, in contrast to some systems that require two receivers matched in gain and phase. Bearing evaluation and presentation is performed automatically by the MA1110 Processing and Display Unit, into which is fed the signal containing azimuthal information derived from the antenna system

and the receiver. The system can be installed in most types of vehicle to suit the particular operational role. The fitting of the antenna is the most important consideration, and several alternatives are available. It can be fitted, for example, directly on the roof of a standard estate car, with no attempt at concealment; or on the roof of a van, with a cover or simple disguise. At the other end of the scale, it can be fitted within the profile of the vehicle by using a glass-fibre ‘hi-top’ to conceal the nature of the operation completely.

**VHF/UHF Radio Direction Finding RTA 1470 Series:** This is a similar system to the 3200 series but is designed to operate from a fixed position, either in a vehicle or from a permanent site.

**Tactical Communications Interception System RS3153:** The RS3153 intercept position provides the operator with search, monitoring and recording facilities, all of which are controlled from a single centralized control panel. One of the two receivers supplied with each position is used primarily for manual or automatic search operations, and the other for monitoring purposes. In automatic search mode the receiver is made to scan at a pre-





**Above:** The Racal Cougar net handset, showing the transceiver, which is carried in a webbing pouch, and (lower illustration) the cable connected microphone.

determined rate through a list of target frequencies held in memory, or across a prescribed frequency band. If activity is detected by the operator, or automatically by the carrier operated relay (COR) in the receiver, the search is stopped, and the receiver settings can be transferred by a single keystroke to the monitor receiver for recording and to a DF system if available. The dedicated cassette recorder connected to the monitor receiver can be controlled by the operator or set to respond to signals from the COR. The automatic search is then resumed, and new activity can be recorded using the search receiver and its associated recorder, or transferred to other operator positions. Split headphones, each earpiece with individual volume controls, allow the operator to listen to one or both receivers, while the boom microphone allows him to add his own comments on the second track of the relevant recorder. External connections provide for intercom and data exchange with other operator positions and for integration into larger, computer controlled EW systems. Ancillary equipment, including panoramic signal display units, demodulators and printers, are available to suit individual requirements. The emphasis throughout is on ease of operation, with comprehensive displays to provide the operator with complete information on all aspects of the work in hand, including receiver settings, automatic prompts and equipment status.

#### **Unattended Expendable Jammer RJS3140:**

This is a low power barrage jammer designed for remote deployment against hostile communications nets operating in the frequency band 20–90MHz. Powered from a small internal battery and triggered by an internal timer, it radiates a 10W wideband signal for a minimum of two hours. Its operating parameters, centre frequency, bandwidth (selectable between 1 and 31MHz) and switch-on-time, are injected from a separate programming unit (MA1065)). RJS3140 is a completely sealed unit, which accepts control data by means of an optical link from the MA1065 – a small calculator-type device with a 16-character display. This small, easily concealed jammer is intended for use against important targets, which for various reasons are out of effective range of stand-off jammers. A number of them can be grouped together to increase the area of coverage as well as to make location by enemy DF more difficult, and they will effectively stop all location reception within their operating band. Used at close range, they provide the simplest available technique for attacking frequency-hop-

ping radios. Deployment is by hand emplacement (for example, by special forces), and the jammer is not normally regarded as recoverable.

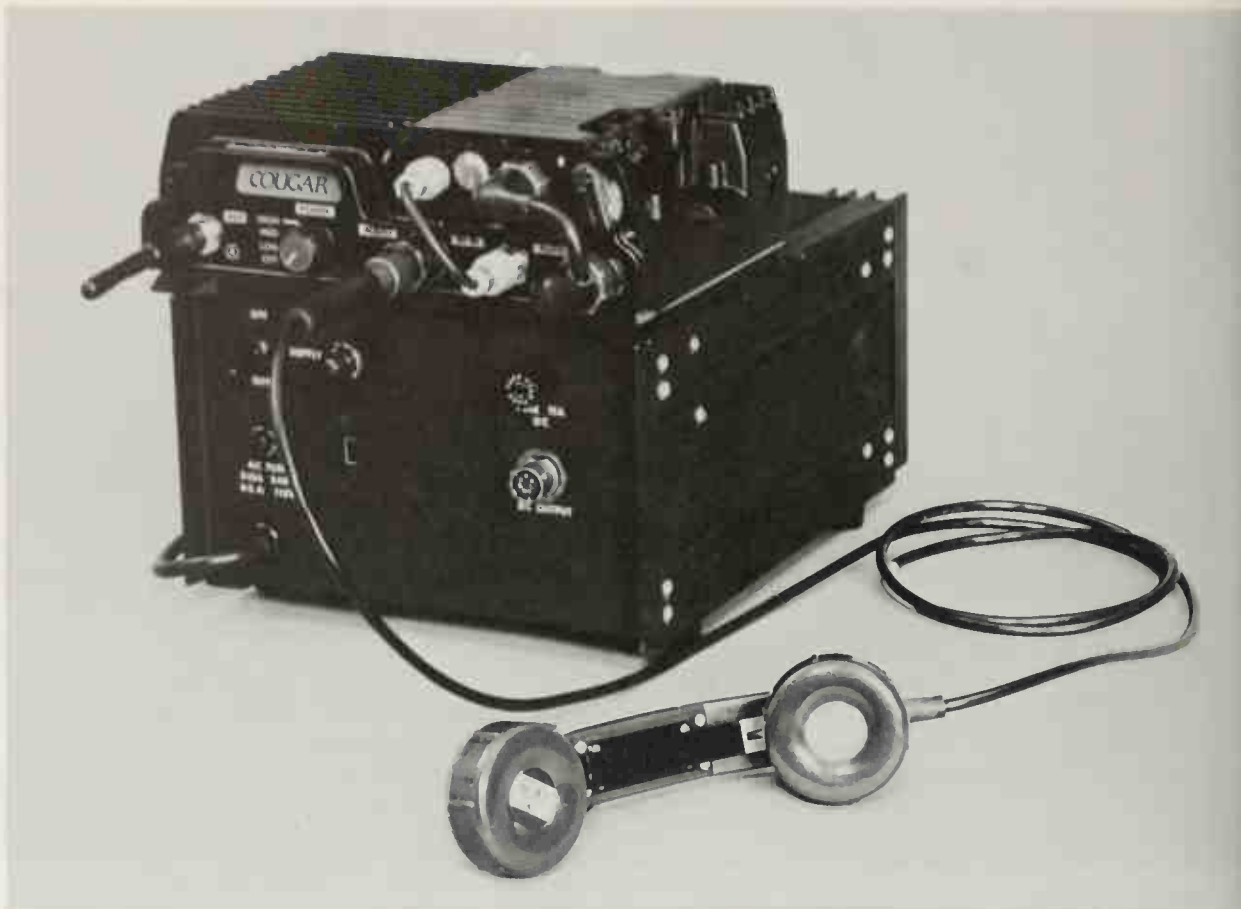
**Data:** dimensions 80mm × 133mm × 279mm; weight 2.5kg (including battery); frequency range 20–90MHz; operational time 2 hours minimum (–10°C to 60°C).

**Jameat:** Jameat is a dual purpose unit, equally usable for low cost training or for offensive EW operations. The only connection between Jameat and the CNR is via the outlet on the radio normally used for the handset. When this connection is made, it transforms the CNR into an ECM unit capable of generating a wide variety of jamming signals. Internally generated white noise, single tones, rapidly changing multiple tones or externally generated signals may be used to modulate the transmitter of the associated CNR. In the offensive role, Jameat can be connected into the audio-keying input of most radio transmitters regardless of RF power output, easily transforming normal communications equipment into an EW jammer. Jameat can be used in manpack- or vehicle-mounted configurations and may be interfaced with a transceiver normally operated through a handset. Power is derived from a clip-on battery pack, a vehicle system or from the transceiver in use if DC is available through the audio interconnect lead. No modifications are required to be made to the associated radio, thus allowing it to be used in the normal way for communications purposes when the adaptor is switched off.

**Data:** dimensions 270mm × 140mm × 70mm; weight 2.1kg (including battery).

**Racal Cougar net:** The Cougar net system consists of a series of linked talk-through stations, which rebroadcast communications from the user's handheld, static, mobile or transportable station. Up to five talk-through stations may be linked in a chain if required. This gives the technical flexibility required when, for example, a large city network, consisting of two or more UHF nets, needs to be linked to one or more urban nets using VHF. It also gives tactical flexibility where several unit networks need to be combined into a single command net for combined operations. The system is run from a Cougar net controller, which can work from any network outstation and allows the system controller to change the system configuration and frequencies at will. This makes the system extremely flexible and able to meet a changing operational requirement. Racal has made the Cougar net communications system simple to use. This has





**Above:** One of the static base stations for Rascal Cougarnet.

been done by using a building-block approach. There is one hand-held transceiver and one duplex talk-through radio. From these basic sets the user can build a system consisting of personal radio overt, personal radio covert, static/base stations, mobile stations, transportable stations, talk-through stations and link stations. Talk-through and link stations, with their associated control equipment, are an important part of the integrated system design philosophy of Cougar. The talk-through unit is completely transparent to Cougar transmissions and not only extends the range because of its repeat facility but also retains the signal quality by reconstituting the digital bits prior to retransmission. The station can be equipped with full redundancy so that, in the unlikely event of equipment failure, a second station may automatically take over from the first. Links may be added to the talk-through so that, for example, an urban UHF net can be linked to a rural VHF net. Equally, when the operational situation so demands, two or more UHF or VHF nets can be joined.

**Employment:** Currently in service with British Army in Northern Ireland.

**Data, personal radio:** *frequency range* 68–88MHz, 132–174MHz, 403–470MHz; *channels* 10 user programmable; *power output* 2W or 5W; *power supply* 10V Ni-Cad battery or primary cell cassette; *dimensions* 205mm × 75mm × 30mm; *weight* 750g.

**Data, static, mobile and transportable stations:** *frequency range* as personal radio; *channels* as personal radio; *power output* 2/10/20W (VHF), 2/5/10W (UHF); *power supply* 12V battery, 12/24V vehicle or mains power; *dimensions* 100mm × 240mm × 240mm; *weight* 8kg.

**Data, link/talk-through:** *frequency range* as personal radio; *channels* 8 (minimum); *power output* 20W; *power supply* 215–265V AC, 10–15V DC; *dimensions* 483mm × 222mm × 160mm; *weight* less than 20kg.

### **Rascal Comsec Speech Security Equipment**

Rascal Comsec Limited is the Rascal Electronics Group specialist in the expanding field



**Above:** The Racal Comsec MA4225 Miniature Voice Encryption Unit.

of communications security. Analogue speech encryption units are available using time division multiplex and other techniques. These units achieve an extremely high degree of security together with good voice recognition and can be used over all types of communications links carrying voice traffic. Digital speech encryption units are also available. These offer a higher degree of security – with digital systems, it is impossible to detect with an ordinary receiver whether speech is being transmitted or not. From these basic encryption units, a range of portable and static telephone systems has been derived for both commercial and military use. All are unobtrusive and simple to operate.

**Telephone Encryption Unit MA4400:** This high-security telephone unit has the appearance of a standard telephone but contains in addition a miniature voice encryption unit. It therefore blends in with a normal office layout without looking at all obtrusive. Businessmen and people who need to convey confidential information over the public telephone network can use MA4400 with the assurance that

anyone attempting to intercept the call will hear only the unintelligible scrambled or encrypted message. An extremely high degree of security is provided by the unit with over  $10^{31}$  keys (encryption codes) available,  $10^{12}$  via the telephone's push-button dial keypad.

**Portable Telephone Encryption Unit MA4227:**

Covert anti-terrorist operatives may have a requirement for a robust, portable encryption unit that is unobtrusive in appearance, adaptable to a variety of telephone handsets and independent of local power supplies. MA4227 has been designed to meet these requirements and consists of a slimline executive briefcase containing an audio encryption unit, an adjustable acoustic coupler, battery pack and charger. Facilities for connection to either a radio transceiver or to the telephone line are provided, together with an integral telephone handset. The speech processing is performed digitally. The analogue/digital/analogue conversions between the input and output of the unit are executed at a high clock rate to achieve good voice recognition and speech quality. The encrypted transmitted audio signal is maintained within a 2kHz bandwidth to enable the unit to work over standard telephone lines as well as HF SSB radio circuits and VHF/UHF carrier systems.

**Digital Voice Encryption Unit MA4463:** An appliqué device, designed to secure VHF combat net radios, this is capable of operation with the majority of existing VHF radios with date capability, and is easily coupled between the radio's existing handset and the date input. The unit offers ease of operation coupled with a high level of speech quality and voice recognition. With the rapid growth of sophisticated electronic warfare equipment, which can locate, intercept and analyze tactical voice communications, it has become increasingly necessary to deploy effective countermeasures to safeguard such communications. While analogue speech encryption units still provide effective communications security, it has long been recognized that digital voice encryption techniques are intrinsically more secure, since more complex encryption algorithms can be employed. MA4463 meets this requirement. Based upon a well known stream cypher technique, it combines high security with small size and weight. The electronics are housed in an environmentally sealed case. The important criterion of power consumption has been a prime consideration. In quiescent periods, the current consumption is reduced from 37 to 7 milliamps. The actual voltage requirements are from 7 to 16 volts from the host radio. On



**Above:** Security Systems International ECM System 15.

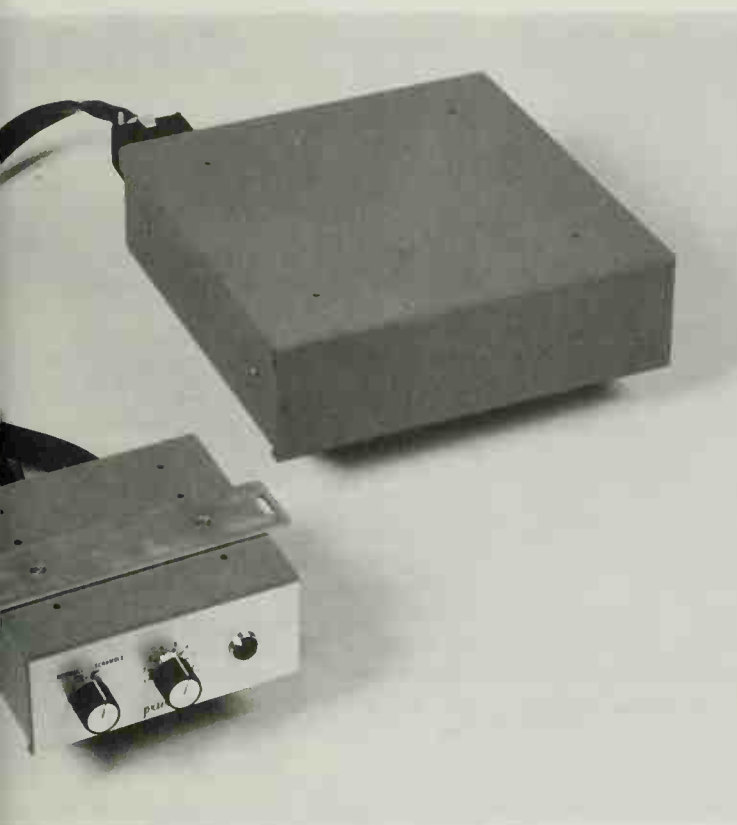
transmit, the audio signal is digitized, encrypted and then baseband-filtered for transmission. On receive, the encrypted signal is decrypted, converted back to analogue, with the resultant audio signal being amplified and passed directly to the handset.

**Miniature Voice Encryption Unit MA4225:**

This highly portable, pocket sized voice encryption unit employs time division multiplexing and frequency dispersion techniques to encrypt the speech signal. Designed primarily for use with any portable or manpack radio, the unit offers a very high degree of speech security with  $10^{31}$  available code settings. Controls on the MA4225 have been kept to an absolute minimum to facilitate simplicity of operation: only two areas of control are provided, the mode selection switch and the keyboard. Three operating modes are selectable – 'clear', 'secure' and 'standby'. An extra position on the mode switch designated 'key' is used for loading the base key in conjunction with the associated keyboard. This keyboard comprises a 16-character alpha-numeric format laid out in a  $4 \times 4$  matrix with the addition of an extra key 'ST', which is used in the entry of the ten character base keys.







**Above:** The Security Systems International P-38 Scrambler for use with AM and FM radio equipment.

**Left:** The Security Research Helmet Receiver.

### Rank Telecommunications Communications Equipment

**Mitre Two-Way Pocket Phone:** Mitre is a VHF transmitter/receiver, designed to be compact and lightweight. The unit has four preselected crystal controlled channels suitable for single- or two-frequency simplex operation. A slide-on battery pack is rechargeable and can give up to 13 hours of service. Mitre has only two controls: a volume on/off switch and a channel selector. A multi-pin plug connects to the selected microphone/speaker assembly. Mitre is built on a modular principle to enable it to be serviced simply and quickly.

**Employment:** Various British police forces.

**Data:** *dimensions* 132cm × 2.9cm × 9.5cm; *weight* 0.48kg; *frequency coverage* 68–100MHz, 145–174MHz; *mode* FM, simplex single or two-frequency; *number of channels* 1–4; *endurance* 10–13 hours.

**UHF Transceiver Model 203:** A hand-held 203 UHF transmitter receiver with built-in antenna, loudspeaker and microphone. The equipment has only three controls: an on/off volume control, a three-way channel switch, and a press-to-talk button. The 203 has rechargeable batteries.

**Employment:** This equipment is used by

several private security organizations in the UK and elsewhere.

**Data:** *dimensions* 20.1cm × 3.3cm × 6.8cm; *weight* 0.5kg; *frequency coverage* 440–470MHz; *mode* simplex, single or two-frequency; *channel separation* 25KHz; *number of channels* 1–3; *endurance* 9–10 hours.

### Security Research Helmet Receiver

Security Research developed the Helmet Receiver for emergency and riot communications. The receiver is compatible with commercial hand-held transmitters and can be added to existing networks. It is available in low band VHF, high band VHF or UHF, and the frequency can be altered by a simple change of the crystal within the bandwidth. The sound is received via an acoustic transducer mounted inside the padding of the helmet, creating no hazard to the wearer. The antenna is spiralled round the acoustic tube, leaving no trailing wires. A rotary switch selects 'low', 'medium', or 'high' so that users can adjust the sound level to their environment. The receiver is powered by a disposable/rechargeable PP3 battery in a push-in holder, giving a minimum of eight hours of use.

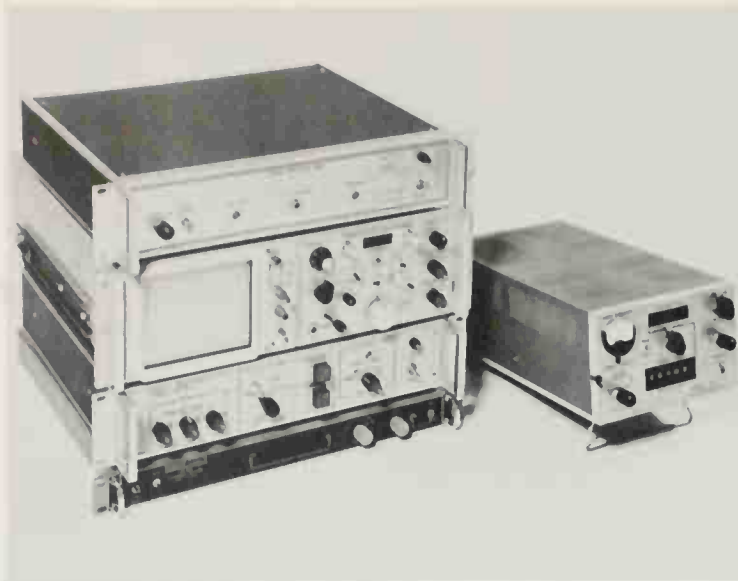
**Data:** *dimensions* 110mm × 105mm × 35mm; *weight* 200g; *frequencies* 75–85MHz or 150–170MHz (VHF) and 420–520MHz (UHF).

### Security Systems International Secure Communications Equipment

**ECM System 15:** This provides a comprehensive countermeasure capability, including detection of secret carrier transmitters (devices that use power or telecommunications lines as signal paths), detection of secret transmitters (wireless transmitting devices), detection of any alteration or bypass technique employed against a standard telephone instrument regardless of whether receiver element, transmitter element, or additional microphones are employed, trace wire pairs through walls or other structural features in order to determine termination or point of origin, determination of presence of microphone or unidentified wires regardless of type of microphone employed (carbon, dynamic, crystal), activation of microphone detected on wires so that the exact location can be pinpointed. All components of the system are housed in four lightweight carrying cases designed to protect the equipment, while providing unobtrusive means for movement.

**Frequency-Hopping Transceiver Gazelle Mk 1:** A VHF frequency hopping transceiver system greatly reduces the risk of detection





**Above:** Security Systems International DM760 direction finding equipment.

**Below:** Motorola's MX320 Handie-Talkie set.



**Employment:** British Army, Royal Navy, various British police forces, Swedish police, Hong Kong police, and many other police forces.

## UNITED KINGDOM/USA

### Security Systems International Direction Finding and Monitoring System DM760 RF

Manufactured in the United States and marketed by SSI of Cambridge, England, DM760 RF is designed for search, acquisition, direction finding and analysis of RF signals in the HF/VHF and UHF frequency ranges. It consists of two sub-systems: the HF, which operates between 2MHz and 30MHz, and the VHF/UHF between 30MHz and 1,000MHz. It provides four functions: search, acquisition, direction finding and analysis. The system can provide multiple reception of signals, and scan and search at the same time as analysis. It is transportable in a one-ton truck and trailer, and particularly suitable for IS situations in a rural or urban environment.

## UNITED STATES OF AMERICA

### Motorola Radio Equipment

**Hand-Held Radio HT220 Handie-Talkie:** Developed by Motorola of Illinois, HT220 is a proven hand-held radio ideal for IS use.

**Data:** *dimensions* 17.8cm × 7.1cm × 4.7cm; *weight* 0.765kg (Ni-Cad battery version); *frequency coverage* 406–420MHz, 450–470MHz, 470–512MHz; *mode* FM, simplex, three-frequency; *channel separation* 25KHz; *number of channels* 4; *endurance* 8 hours (Ni-Cad battery), 40 hours (mercury battery).

**Hand-Held Radio MX320 Handie-Talkie:** This is one of a series (MX320–MX360). The five housings are designed to operate on up to eight frequencies, and there are three available power levels (1, 2 or 5 watts). The MX320 series offers an impressive range of options and is in widespread use throughout the world.

**Employment:** United States and several Far East countries.

**Data:** *dimensions* 7.2cm × 3.6cm × 16.8cm (7-hour battery); *weight* approx. 0.75kg; *frequency coverage* 403–430MHz, 440–512MHz; *mode* FM, simplex, three-frequency; *channel separation* 25KHz; *number of channels* up to 8; *endurance* 1-, 7- or 14-hour batteries.

and also provides a real-time countermeasure to jamming. A bonus is a low level security transmission, equal to low level commercial scramblers. Gazelle 1 is switched hi or lo power 25 watts or 1 watt.

**Portable VHF Auto Repeater:** This battery powered, VHF 5-watt repeater station for emergency security operation use acts as an emergency base station for IS operations. It is available in various powers and frequencies to special order.

**Scrambler P-38:** For use with AM and FM two-way radio equipment, the SSI P-38 scrambling equipment gives a four-band voice splitting facility and eight combinations.

**Employment:** SSI Equipment is sold mostly in the Middle East and Africa.

### Stornophone Portable Radios

The Stornophone COP500 range is available for operation in both VHF and UHF frequency bands. The sets are equipped for switching on two or three crystal-controlled channels and have a transmitter output power of 300–500mW. Power source is a 12.4V Ni-Cad cassette-type battery, which is rechargeable about 500 times. Both the VHF and UHF sets can be fitted for hand-held use, or can be supplied with a separate hand-held microphone/speaker unit for extended control. There are eleven alternative specifications in the 500 series.

**Variants:** The COP is an advance technology variant of the COP500, and can be equipped with up to twelve channels. Though suitable for outdoor use, the more rugged 500 series are probably better for IS situations.

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Colonel Michael Dewar is the author of a number of books, including *The British Army in Northern Ireland*, and has first-hand experience of peacekeeping in riot-torn Northern Ireland and in operating anti-terrorist systems. He is thus well qualified to describe and comment upon the various means available to counter-terrorist organizations, to explain the problems, defects and gaps and to point the way forward to the new and ever-more sophisticated technologies that are emerging.

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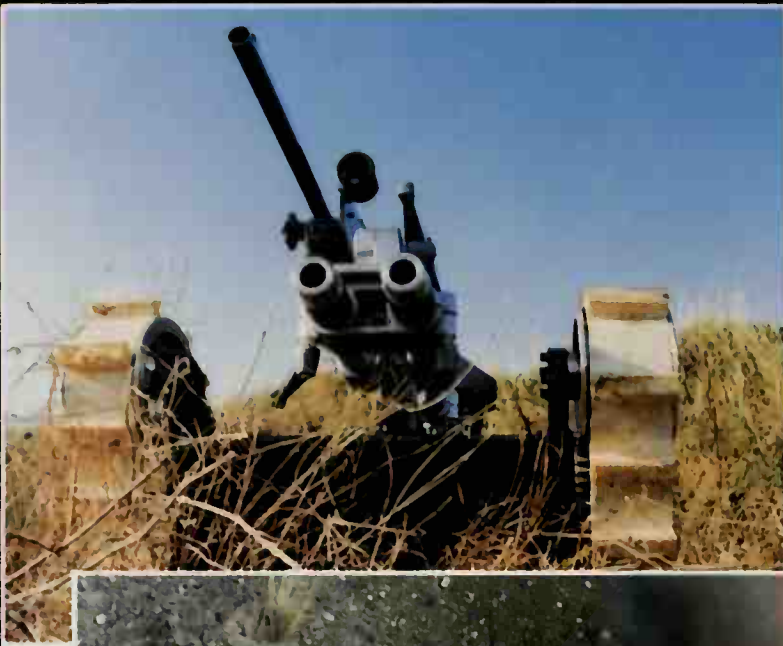
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